Ministry of
Northern Development
and Mines
Ontario

Report of Activities
1989
Resident Geologists

Ontario Geological Survey
Miscellaneous Paper 147

edited by
K.G. Fenwick, P.E. Giblin and A.E. Pitts

1990

90-04248/

© 1990 Queen's Printer for Ontario
Printed in Ontario, Canada

ISSN 0704-2752 (series)
ISSN 0319-9487 (sub-series)

Publications of the Ontario Geological Survey and the Ministry of Northern Development and Mines are available from the following sources. Orders for publications should be accompanied by cheque or money order payable to the *Treasurer of Ontario*.

Reports, maps and price lists (personal shopping or mail order):
Public Information Centre, Ministry of Natural Resources
Room 1640, Whitney Block, Queen's Park
Toronto, Ontario M7A 1W3

Reports and accompanying maps only (personal shopping):
Publications Ontario
Main Floor, 880 Bay Street
Toronto, Ontario M7A 1N8

Reports and accompanying maps (mail order or telephone orders):
Publications Ontario, Ministry of Government Services
5th Floor, 880 Bay Street
Toronto, Ontario M7A 1N8
Telephone (local calls), 965-5300
Toll-free long distance, 1-800-668-9938

Every possible effort is made to ensure the accuracy of the information contained in this report, but the Ministry of Northern Development and Mines does not assume any liability for errors that may occur. Source references are included in the report and users may wish to verify critical information.

If you wish to reproduce any of the text, tables or illustrations in this report, please write for permission to the Director, Ontario Geological Survey, Ministry of Northern Development and Mines, 11th Floor, 77 Grenville Street, Toronto, Ontario M7A 1W4.

Parts of this publication may be quoted if credit is given. It is recommended that reference be made in the following form:

Blackburn, C.E., Hailstone, M.R., Delisle, P.-C. and Storey, C.C. 1990. Kenora Resident Geologist's District—1989; *in* Report of Activities 1989, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 147, p.3-40.

Scientific Editor: C.A. Tchoryk

1000-90-Deyell

Contents

1. NORTHWESTERN REGION

Introduction 1

2. KENORA RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 3
Mining Activity 3
  Dimension Stone 3
  Decorative Stone 3
  Small-scale Mining 3
Advanced Exploration and Development 4
    Consolidated Professor Mines Limited, Shoal Lake 4
    Nuinsco Resources Ltd.-Deak Resources Corporation, Cameron Lake 4
    Boise Cascade Canada Ltd. 4
Exploration Activity 4
  Gold 5
    Lake of the Woods-Shoal Lake Area 5
    Kakagi-Rowan-Pipestone Lakes Area 9
    Umfreville-Treelined Lakes Area 10
    Manitou-Wabigoon-Eagle Lakes Area 10
    Fort Frances-Mine Centre Area 11
  Base Metals 12
  Industrial Minerals 12
    Dimension Stone 12
Ontario Government Incentive Programs 12
Resident Geologist's Staff Activities 12
Acknowledgments 13
Property Examinations 13
  Gold 13
    Hay Island Prospect 13
    Stella Prospect 16
    Gold Hill Mine, and Blackjack and Golden Gate Prospects 17
    Passage Property 18
    Chisholm Island Prospect 18
    Ambrose Prospect 19
    Aronson Lake Occurrence 20
    S-500 Occurrence 20
    Dryden-Red Lake Occurrence 22
  Base Metals 22
    Black Lake Copper-Zinc Occurrence 22
    Dome Exploration Jadakin Lake Occurrence 24
    Glatz Occurrence 24
Research by Kenora Resident Geologist's Staff 25
  Gold Studies in the Manitou-Stormy Lakes Belt 25
    Introduction 25
    General Geology 25
    Structural Geology 25
    Characteristics of Gold Occurrences 26
      Vein Geometry 30
      Deposit Types 31

Sulphide Association 32
Alteration Products 32
Delineation of the Trend of Gold-bearing Structures 32
Conclusions 33
Recommendations 33
Geological Data Inventory Folios 34
Drill Core Storage Program 34
Recommendations For Exploration 36
Base Metals 36
Gold 37
Ontario Geological Survey Activities 38
Research by Other Agencies 38
University Theses 38
Bachelor's Theses 39
Master's Theses 39
Doctoral Theses 39
Other Research 39
Selected Publications Received, 1989 39
References 39

TABLES

2.1. Summary of Claims Recorded and Assessment Work Credit. 5
2.2. Exploration Activity During the Year. 7
2.3. Property Visits. 15
2.4. Drill Core Collection Sites. 15
2.5. Characteristics of Investigated Gold Occurrences, Dryden Area. 27
2.6. Maps and Reports Pertaining to the Kenora Resident Geologist's District Issued by the Ontario Geological Survey, 1989. 38

FIGURES

2.1. Kenora Resident Geologist's District 6
2.2. Kenora Resident Geologist's District 14
2.3. Geology of the S-500 Occurrence. 21
2.4. Geology of the Dryden–Red Lake Occurrence. 23
2.5. Geology and Gold Occurrences, Lower Manitou Lake Area. 26
2.6. Schematic of Common Vein and Fabric Geometries. 31
2.7. Trend of Gold-bearing Structures, Church Lake Area. 33
2.8. Geological Data Inventory Folios, Kenora Resident Geologist's District. 35

3. RED LAKE RESIDENT GEOLOGIST'S DISTRICT–1989

Introduction 41
Mining Activity 43
Placer Dome Inc.–Campbell Red Lake Mine 43
Dickenson Mines Ltd.–Arthur W. White Mine 43
Advanced Exploration and Development 48
Inco Gold Inc.–Cochenour Willans Mine 48
Gold Fields Canadian Mining Ltd.–Springpole Property 48
Twin Gold Mines Ltd.–Lingman Lake 48
McFinley Red Lake Mines Ltd. 48

Exploration Activity 48
  Red Lake Greenstone Belt 48
    BHP-Utah Mines Ltd. 48
    Black Cliff Mines Ltd. 49
    Campbell Red Lake Mine (Placer Dome Inc.) 49
    Canhorn Mining Corporation-United Reef Petroleums Ltd. 49
    Chevron Minerals Ltd. 49
    Goldbrae Developments Ltd. 49
    Jamie Frontier Resources Inc. 49
    Laverty Red Lake Resources Inc. 49
    Noramco Explorations Ltd. 49
    Noranda Exploration Company, Limited 49
    Placer Dome Inc. 49
    Red Lake Buffalo Resources Ltd. 49
    O. Rivard 49
    Sherritt Gordon Limited 50
  Dixie Lake Area 50
    Mutual Resources Ltd.-Teck Corporation 50
  Birch Lake Area 50
    Canadian Patricia Exploration Ltd. 50
    Falconbridge Ltd. 50
    Flint Rock Mines Ltd. 50
    Gold Fields Canadian Mining Ltd. 50
    Noranda Exploration Company, Limited 50
    Placer Dome Inc. 50
    Silverside Resources Inc. 50
  Wesleyan Lake Area 50
    Champion Gold Resources Inc. 50
  Northern Greenstone Belts 50
    McInnes Lake 50
    Favourable Lake 50
    North Spirit Lake 50
    Lingman Lake 50
    Stull Lake 50
Resident Geologist's Staff Activities 50
Acknowledgments 51
Reconnaissance of the Stull Lake Greenstone Belt 51
  Location and Access 51
  Previous Work and Exploration Activities 51
  Quaternary Geology 51
  General Geology 52
    Hayes River Group 52
    Oxford Group 52
  Alteration 52
  Structure 52
    Wynne Bay Deformation Zone 52
  Economic Geology 52
  Gold Occurrences 52
    Ellard Occurrence 52
    Wynne Bay South Occurrence 54
    Wynne Bay North Occurrence 55
    Cyril Knight Occurrence 55
  Sulphide Occurrences 55

Yvonne Occurrence 55
Rapson Bay Chalcopyrite Occurrences 55
Rapson Bay-Stull Lake Occurrence 55
Mink Occurrence 56
Birse-Richardson Property 56
Property Examinations 56
Gold Occurrences and Prospects 56
Dixie Lake Occurrence 56
Springpole Property 57
Shanty Bay Occurrence 58
Base Metal Occurrences and Prospects 60
A.S. Creighton Occurrence 60
Fisher Islands Occurrences 61
Slate Bay Occurrence 62
Trout Bay Prospect 63
Zinc Pit Zone 64
Frog Pit Ni-Cu Zone 65
Drill Core Storage Program 65
Recommendations for Exploration 65
Stull Lake Greenstone Belt 65
Dixie Lake Area 66
Base Metals in the Red Lake Greenstone Belt 66
Ontario Geological Survey Activities 67
Research by Other Agencies 67
Publications Received, 1989 67
References 67

TABLES

3.1. Summary of Claims Recorded and Assessment Work Credit. 41
3.2. Exploration Activity During the Year. 42
3.3. Summary of Core from the Red Lake Resident Geologist's District in the Kenora Drill Core Library. 66
3.4. Maps and Reports Pertaining to the Red Lake Resident Geologist's District, Issued by the Ontario Geological Survey, 1989. 67

FIGURES

3.1a. Red Lake Resident Geologist's District 44
3.1b. Red Lake Resident Geologist's District 45
3.2a. Red Lake Resident Geologist's District 46
3.2b. Red Lake Resident Geologist's District 47
3.3. General Geology of the Stull Lake Greenstone Belt. 53
3.4. Geology of the Dixie Lake Area. 57
3.5. Geology of the Springpole Property. 59
3.6. Geology of the Shanty Bay Occurrence—Dent Township. 60

4. SIOUX LOOKOUT RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 69
Mining Activity 69
Advanced Exploration and Development 76
Exploration Activity 76
Geological Data Inventory Folio Program 79
Resident Geologist's Staff Activities 79
Property Examinations 80
Lac Mineral's Hasaga Deposit 80

  - Introduction 80
  - Location and Access 80
  - Exploration History 80
  - Regional Geology 80
  - Property Examination 82
  - Discussion 82
- The Ontario Gold Joint Venture Misehkow River Gold Prospect 82
  - Introduction 82
  - Location and Access 82
  - Exploration History 83
  - Regional Geology 83
  - Property Examination 84
- Gold Occurrences in the Dempster Lake Area 85
  - Introduction 85
  - Location and Access 85
  - Exploration History 85
  - Regional Geology 85
  - Property Examination 86
  - Sudbury Point Gold Occurrence 86
  - North Dempster Lake Gold Occurrence 86
  - South Dunlop Lake Gold Occurrence 87
  - Discussion 88
- Seeseep Lake Gold Occurrence 88
  - Introduction 88
  - Location and Access 88
  - Exploration History 88
  - Regional Geology 88
  - Property Examination 89
- The Ontario Gold Joint Venture Arseno Lake Base Metal Prospect 90
  - Introduction 90
  - Location and Access 91
  - Exploration History 91
  - Regional Geology 91
  - Property Examination 91
  - Discussion 92
- Sabin Base Metal Prospect, Savant Lake Area 93
  - Introduction 93
  - Location 93
  - Exploration History 93
  - Regional Geology 93
  - Property Examinations 93
  - Discussion 94
- The Horn Area, North Sturgeon Lake 95
  - Introduction 95
  - Location and Access 95
  - Exploration History 95
  - The Exploration History of BG130 96
  - Regional Geology 96
  - Property Examinations 96
    - BG130 96
    - AL499 (Rainbow Island) 96
    - Hotel Point Area 97
    - Discussion 97

Diamond-drill Core Storage Program 97
Recommendations for Exploration 98
    Base Metals 98
    Gold 98
Ontario Geological Survey Activities 99
Selected Publications Received 99
References 99

TABLES

4.1. Exploration Activity During the Year. 70
4.2. Summary of Claims Recorded and Assessment Work Credit. 71
4.3. OMEP Programs in the Sioux Lookout Resident Geologist's District. .. 76
4.4. List of Geological Data Inventory Folios. 79
4.5. Property Examinations in 1989. 80
4.6. Summary of Sioux Lookout District Core in the Library. 98

FIGURES

4.1a. Sioux Lookout Resident Geologist's District 72
4.1b. Sioux Lookout Resident Geologist's District 73
4.2a. Sioux Lookout Resident Geologist's District 74
4.2b. Sioux Lookout Resident Geologist's District 75
4.3. Location Map for Lac Minerals Ltd.'s Hasaga Deposit. 81
4.4. Location Map for the Misehkow River Gold Occurrence. 83
4.5. Location Map for the Sudbury Point, North Dempster Lake and South Dunlop Lake Gold Occurrences. 87
4.6. Deformation Zones and Gold Occurrences in the Dempster Lake Area. 89
4.7. Location Map for the Arseno Lake Base Metal Deposit and the Seeseep Lake Gold Occurrence. 90
4.8. General Geology around the Seeseep Lake Gold Occurrence. 90
4.9. Location Map for the Sabin Base Metal Deposit. 93
4.10. South Face of Road Cut Trending 120°, Sabin Prospect. 94
4.11. Location Map for the Rainbow Island, Rickaby Showing and Hotel Point Gold Occurrences. 95
4.12. Prospects in the Horn Area, Sturgeon Lake. 95

5. THUNDER BAY RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 101
Mining Activity 101
Advanced Exploration Activity and Development 101
    Madeleine Mines Ltd., Lac des Iles Area 101
    Mimiska Mining Company Inc., Fern–Elizabeth Prospect 101
Exploration Activity 101
    Snodgrass Lake Prospect 103
Resident Geologist's Staff Activities 103
Property Examinations 103
    North Coldstream Mine 103
    Home Lake Cu-Zn Occurrence 107
Drill Core Storage Program 107
    Rio Tinto Canadian Exploration Ltd., Burchell Lake Area 108

Butte Resources Limited, Sande–Stewart Property, Sawbill Bay 109
Recommendations for Exploration 110
Shebandowan Greenstone Belt 110
Marmion Lake Batholith 112
Graham to Highway 527 Area 112
Garden Lake Belt 112
Ontario Geological Survey Activities 114
Research by Other Agencies 114
Lakehead University Activities 114
Others 114
Selected Publications Received 114
References 114

TABLES

5.1. Summary of Claims Recorded and Assessment Work Credit. 103
5.2. Exploration Activity in the Thunder Bay Resident Geologist's District. . 104
5.3. Diamond–drilling Results on the Snodgrass Project, Tandem Resources Ltd.–Storimin Exploration Limited, 1989. 107
5.4. Diamond–drilling Results on the Sande–Stewart Property, Marmion Lake, Butte Resources Limited, 1988. 109
5.5. Drill Core Stored at the Thunder Bay Drill Core Library, 1989. 111

FIGURES

5.1. Thunder Bay Resident Geologist's District 102
5.2. Geology and Copper Occurrence Distribution of the Western Part of the Shebandowan Greenstone Belt. 108
5.3. Drill Plan of Selected Drill Holes, Butte Resources Limited, Sawbill Bay Area, Marmion Lake. 110

6. BEARDMORE–GERALDTON RESIDENT GEOLOGIST'S DISTRICT–1989

Introduction 115
Milling Activity 115
Advanced Exploration and Development 115
Exploration Activity 115
Resident Geologist's Staff Activities 115
Property Examinations 124
Beardmore–Geraldton Area 124
General Geology and Structure 124
Summers Township Property 124
Standingstone–Archie Lakes Occurrence 125
Jacobus Prospect 126
South Onaman River Base Metal Prospects 126
Fort Hope Area 127
General Geology and Structure 127
Gold Deposits 127
Base Metal Deposits 128
Geochronology 128
Boylen Occurrences 128
Research by Resident Geologist's Office Staff 129
Historical Research Project 129
Benefits of Project 129

  - Present Status ... 129
  - The McFarlane-Manion Occurrence ... 130
  - The Larson Occurrence ... 130
  - The Chipman Lake (Powell) Occurrence ... 131
- Drill Core Storage Program ... 131
  - Noranda Exploration Company, Limited—Errington and Lindsley Townships: The Bankfield Mine ... 134
  - Gunnar Gold Inc., Sandra Township ... 134
- Recommendations for Exploration ... 135
- Ontario Geological Survey and COMDA-funded Activities ... 136
- Research by Other Agencies ... 136
- Acknowledgments ... 136
- Selected Publications Received ... 136
- References ... 137

TABLES

6.1. Exploration Programs for the Period January 1, 1989, to November 30, 1989. ... 119

6.2. Historical Research Project: Articles Researched. ... 129

6.3. Assay Values from the McFarlane-Manion Property. ... 130

6.4. Assay Values from the Chipman Lake (Powell) Occurrence. ... 131

6.5. Drill Core Stored at the Thunder Bay Drill Core Library, 1989. ... 135

FIGURES

6.1a. Beardmore-Geraldton Resident Geologist's District ... 116

6.1b. Beardmore-Geraldton Resident Geologist's District. ... 118

6.2a. Beardmore-Geraldton Resident Geologist's District ... 122

6.2b. Beardmore-Geraldton Resident Geologist's District ... 123

6.3a. Beardmore-Geraldton Resident Geologist's District ... 132

6.3b. Beardmore-Geraldton Resident Geologist's District ... 133

7. SCHREIBER-HEMLO RESIDENT GEOLOGIST'S DISTRICT—1989

- Introduction ... 139
- Acknowledgments ... 139
- Mining Activity ... 139
    - Geco Division (Noranda Inc.) ... 139
    - Winston Lake Division (Minnova Inc.) ... 139
  - Hemlo Area Mines ... 141
    - David Bell Mine (Teck-Corona Operating Corporation) ... 141
    - Golden Giant Mine (Hemlo Gold Mines Inc.) ... 141
    - Williams Mine (Williams Operating Corporation) ... 141
- Advanced Exploration and Development ... 141
    - Euralba Mining Ltd.-Fleck Resources Ltd. ... 141
- Exploration Activity ... 141
  - Gold Exploration ... 142
  - Base Metal Exploration ... 147
  - Platinum Group Elements Exploration ... 147
  - Industrial Minerals Exploration ... 148
  - Rare Earth Elements Exploration ... 148
- General Geology ... 148
- Resident Geologist's Staff Activities ... 148
- Property Examinations—1989 ... 149
    - Swill Lake Property ... 149

Pyrite Occurrences North of Manitouwadge 150
Pukatawagan Lake Property 150
Wullie Lake Property 151
Glacier Creek Occurrence (Potter Prospect) 151
Power Creek Occurrence 152
Research by Schreiber-Hemlo Resident Geologist's Staff 153
Rare Earth Element Study 153
Historical Research 153
Recommendations for Exploration 153
Gold 153
Hemlo-Heron Bay-Manitouwadge Area 153
Schreiber-Terrace Bay Area 154
Base Metals 154
Winston Lake Area 154
Lyne Lake-Victoria Lake Area (Northern Killraine and Priske Townships) 154
Santoy Lake-McKellar Lake Area (Tuuri and Walsh Townships) 155
Pic River Area (Page Lake-O'Neill Township) 155
Manitouwadge Area 155
Platinum Group Elements 156
Rare Earth Elements 156
Industrial Minerals 156
Drill Core Storage Program 156
Gold Fields Canadian Mining Ltd., Hemlo Area 157
Ontario Geological Survey Activities 157
Research by Other Agencies 158
Ontario Geoscience Research Grant Program 158
University Theses 158
Selected Publications Received 158
References 158

TABLES

7.1. Ore Reserves and Grades, Geco Division, Noranda Inc. 141
7.2. Ore Reserves and Grades, Williams Mine. 141
7.3. Exploration Activity in the Schreiber-Hemlo District. 142
7.4. Schreiber-Hemlo Resident Geologist's District—Exploration Activity. . 143
7.5. Hole MH-88-01. Diamond-drill Hole Intersections and Assays, Prairie River-Marlhill Property. 147
7.6. Property Examinations-1989. 149
7.7. Analytical Results, Swill Lake. 150
7.8. Analytical Results, Husak-Olson Roads Area. 150
7.9. Selected Grab Samples from Pukatawagan Lake Property. 151
7.10. Assay Results from Wullie Lake Property. 152
7.11. Assay Results of Selected Grab Samples of the Power Creek Occurrence. 153
7.12. Geochemistry, West Dead Horse Creek Subcomplex. 153
7.13. Diamond-drill Core Collected, 1989, Schreiber-Hemlo District. 157

FIGURES

7.1. Schreiber-Hemlo Resident Geologist's District 140

7.2. Schreiber–Hemlo Resident Geologist's District 146

8. NORTHWESTERN REGION INDUSTRIAL MINERALS PROGRAM—1989

- Introduction 161
- Acknowledgments 161
- Mining Activity 161
  - Granite Dimension Stone 161
    - Vermilion Bay Quarries 161
    - Ignace Quarry 164
    - Forgotten Lake Quarry 165
  - Amethyst 165
    - McTavish Township Mines 165
    - Other Amethyst Producers 166
  - Quartz 166
  - Diabase 166
  - Soapstone 166
  - Marble 166
  - Flagstone 166
- Exploration Activity 166
  - Granite Dimension Stone 166
    - Lount Lake Batholith 168
    - Revell Batholith 169
    - Cecil Lake Pluton 169
    - Coldwell Alkalic Complex 169
  - Amethyst 169
  - Silica 169
  - Lithium 169
  - Decorative Stone 170
    - Quartz 170
    - Red Granite 170
  - Graphite 170
- Industrial Minerals Staff Activities 170
- Property Examinations 171
    - Springpole Lake Fluorite-bearing Carbonatite 171
    - French Portage Narrows (Coste Island) Soapstone Occurrence 171
    - Pipestone Peninsula Soapstone Occurrence 174
- Research by Industrial Minerals Staff 174
  - Soapstone Study 174
  - Ignace Area Stone Study 175
    - Revell Batholith 175
    - Cecil Lake Pluton (Indian Lake Batholith) 176
    - Harmon Lake Pluton (Wapakaimaski Lake Pluton) 177
    - Stedman Lake Pluton 177
    - Gneiss Occurrence 177
- Recommendations for Exploration 177
  - Granite Dimension Stone 177
  - Decorative Stone 177
  - Sandstone 177
  - Amethyst 178
  - Wollastonite 178
  - Graphite 178
  - Rare Earths 178

Zircon and High Alumina Minerals 178
Fluorite, Barite and Calcite 178
Other Mines and Minerals Division Activities 178
Research by Other Agencies 178
Selected Publications Received 178
Periodicals 179
References 179

TABLES

8.1. Industrial Mineral Producers and Seasonal Producers 1989. 164
8.2. Exploration Activity During the Year. 167
8.3. Property Visits—Industrial Minerals Program. 171

FIGURES

8.1a. Northwestern Region Industrial Minerals Program 162
8.1b. Northwestern Region Industrial Minerals Program 163
8.2a. Northwestern Region Industrial Minerals Program 172
8.2b. Northwestern Region Industrial Minerals Program 173
8.3. Springpole Lake Alkalic Volcanic Complex. 174
8.4. Plutonic Rocks of the Ignace Area. 176

9. NORTHEASTERN REGION

Introduction 181

10. WAWA RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 183
Mining Activity 186
Algoma Ore Division 186
Renabie Mine 186
Kremzar Mine 186
Magino Mine 187
Magnacon Mine 187
Advanced Exploration and Development 187
Citadel Gold Mines Inc. 187
Canamax Resources Inc. 188
Granges Inc. 188
Hemlo Gold Mines Inc.-Central Crude Limited 188
Exploration Activity 189
Mishibishu Lake Area 189
Wawa-Michipicoten Area 190
Goudreau-Lochalsh Area 190
Missanabie-Renabie Area 191
Resident Geologist's Staff Activities 191
Property Examinations 192
Conboy Lake Zinc-Silver Prospect 192
Langdon Showing 193
Shenango Gold Mine 194
Taylor Showing 194
Research by Resident Geologist's Staff 195
Wawa District Mineral Deposits Database 195
Reconnaissance Mapping, Kabinakagami Lake Greenstone Belt, Hawkins Township Extension 195

- Introduction ... 195
- Location and Access ... 196
- Geology ... 196
- Mafic to Intermediate Metavolcanic Rocks ... 196
- Intermediate to Felsic Metavolcanic Rocks ... 197
- Clastic Metasedimentary Rocks ... 198
- Felsic Intrusive Rocks ... 198
- Late Mafic Intrusive Rocks ... 198
- Structural Geology ... 198
- Economic Geology ... 198
- Geological Data Inventory Folio Program and Exploration Data Management ... 198
- Computer Applications and Mineral Development Related Projects ... 199
  - Computer Applications ... 199
  - Mineral Development ... 199
- Diamond-drill Core Storage Program ... 201
- Recommendations for Exploration ... 201
  - Hawkins Township Gold Prospects ... 201
  - Base Metal and Precious Metal Potential, Wawa District ... 202
  - Granitic and Gneissic Terranes ... 202
- Ontario Geological Survey Activities ... 202
  - Precambrian Geology Section ... 202
  - Geophysics/Geochemistry Section ... 202
  - Aggregate Assessment Office ... 203
- Research by Other Agencies ... 203
  - Ontario Centre for Remote Sensing (OCRS) ... 203
  - Geological Survey of Canada ... 203
  - Bowling Green State University ... 203
  - Queen's University ... 203
  - University of Massachusetts ... 203
  - University of Ottawa ... 203
- Acknowledgments ... 203
- Selected Publications Received ... 203
- References ... 204

TABLES

- 10.1. Exploration Activity During 1989. ... 185
- 10.2. Summary of Claims Recorded and Assessment Work Filed, 1989. ... 185

FIGURES

- 10.1. Wawa Resident Geologist's District ... 184
- 10.2. Exploration Programs in the Wawa District, 1984–89. ... 186
- 10.3. Producing Mines and Underground Exploration, 1984–89. ... 186
- 10.4. Client Services—Number of Visitors, 1989. ... 191
- 10.5. Mineral Occurrences, Kabinakagami Lake Greenstone Belt. ... 193
- 10.6. Location Map for the Hawkins Township Mapping Project. ... 196
- 10.7. Generalized Geology of the Kabinakagami Lake Greenstone Belt and Hawkins Township Extension. ... 197
- 10.8. Geological Data Inventory Folios, Compilation Statistics. ... 199
- 10.9. 1989 Exploration Data and Geological Data Inventory Folios. ... 200

11. SAULT STE. MARIE RESIDENT GEOLOGIST'S DISTRICT—1989

- Introduction ... 205
- Mining Activity ... 205
- Exploration Activity ... 205
  - Belmoral Mines Ltd.–Aurora Gold Ltd. ... 205

Blue Heaven Resources Corp. 205
Duration Mines Ltd.-Aurogin Resources Ltd. 205
Gold Fields Canadian Mining Ltd. 207
Inco Gold Co. 207
Loydex Resources Inc. 207
Noranda Exploration Company, Limited 207
Placer Dome Inc.-Glen Auden Resources Limited 208
Other Exploration Activity 208
Resident Geologist's Staff Activities 208
Stratigraphy of the Elliot Lake Group between Sault Ste. Marie and the Quirke Lake Syncline 209
Introduction 209
The Livingstone Creek Formation 209
General Description 209
The Distribution of the Livingstone Creek Formation 210
Stratigraphic Relationships of the Livingstone Creek Formation 211
The Sub-Thessalon Disconformity 211
Huronian Volcanic Rocks 211
The Thessalon Formation 211
Huronian Volcanic Rocks of the Quirke Lake Syncline 212
The Matinenda Formation 213
Summary and Conclusions 213
The Sault Ste. Marie Drill Core Library 213
Ontario Geological Survey Activities 214
Selected Publications Received 214
References 214

TABLES

11.1. Exploration Activity During the Year. 207

FIGURES

11.1. Sault Ste. Marie Resident Geologist's District 206
11.2. A Gain and Loss Diagram for Paleosol of the Livingstone Creek Formation Compared with Paleosol on Granitic Rocks. 210
11.3. Mafic Dikes (Thessalon Formation) Intruding Livingstone Creek Formation, and Disconformably Overlain by Matinenda Formation. 210
11.4. Variation of P_2O_5 and TiO_2 with Stratigraphic Height, Thessalon Formation, Sault Ste. Marie. 212

12. TIMMINS RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 217
Claim Staking Activity 217
Incentives Programs 217
Ontario Mineral Exploration Program (OMEP) 217
Ontario Prospectors Assistance Program (OPAP) and Ontario Mineral Incentive Program (OMIP) 217
Mining Activity—Operating Mines 1989 217
Base Metals 217
Falconbridge Limited, Kidd Creek Mine 217
Timmins Nickel Inc.-BHP-Utah Mines Ltd. 227
Precious Metals 231
Asarco Exploration Company of Canada Ltd., Aquarius Mine 231
Canamax Resources Inc., Bell Creek Mine 231

- ERG Resources Inc. 231
- Falconbridge Gold Corporation 232
  - Hoyle Pond Mine 232
  - Owl Creek Mine 232
- Giant Yellowknife Mines Limited, Timmins Operations 232
  - No. 1 Mine 232
  - No. 3 and No. 5 Pits 232
  - Timmins Surface 233
  - Heap Leaching 233
- Placer Dome Inc. 233
  - Detour Lake Mine 233
  - Dome Mine 233
- St. Andrew Goldfields Ltd. 233

Industrial Minerals 234
- Luzenac Incorporated 234
- Roseval Silica Incorporated 234

Advanced Exploration And Development 235
- American Reserve Mining Corporation–Placer Dome Inc. 235
- Belmoral Mines Ltd.–Broulan Resources Inc. 235
- Belmoral Mines Ltd.–Vedron Limited, Joint Venture 235
- Chesbar Resources Incorporated–Murgold Resources Incorporated 236
- Gold Bar Resources Inc.–Canadian Gold Resources Inc. 236
- Marshall Minerals Corp.–Gail Resources Incorporated 237
- Muscocho Explorations Limited–Jerome Gold Mines Corporation–E.B. Eddy Forest Products Limited–McNellan Resources, Inc.–Chesbar Resources Inc. 238
- Orofino Resources Limited 238
- Sherritt Gordon Limited–Newphos Ltd. 238
- Tarzan Gold Inc.–Noranda Exploration Company, Limited 239
- Young–Shannon Gold Mines Limited 239

Abitibi Belt Exploration Activity 240
- R.E. Allerston 240
- American Barrick Resources Corporation–HSK Minerals Limited 240
- J. Arengi 240
- Asarco Exploration Company of Canada Ltd. 240
- Aslan Exploration Development Limited 240
- Aurogin Resources Ltd. 240
- BHP–Utah Mines Ltd. 240
- Black Cliff Mines Ltd. 240
- Canhorn Mining Corporation 240
- Canamax Resources Inc. 240
- Chevron Resources Canada Limited 241
- Cominco Ltd. 241
- Comstate Resources Ltd. 241
- Cross Lake Minerals Ltd.–Teck Corporation 241
- Diepdaume Mines Ltd. 241
- Ekersval Resources Ltd. 241
- Falconbridge Limited 241
  - 1989 Drilling Summaries 241
- Fiedmont Resources Ltd. 242
- Golden Crescent Resources Corp.–Placer Dome Inc. 242
- Golden Dragon Resources Ltd. 242
- Golden Pheasant Resources Inc. 242
- Granges Exploration Ltd. 242

L. Hill 242
HSK Minerals Limited 242
Inco Exploration and Technical Services Inc. 242
James Bay Kaolin Corporation 243
Kaphearst Resource Corporation 243
Manridge Explorations Limited 243
Markbridge Resources Ltd. 243
Marshall Minerals Corporation 243
W. Miller 243
Moneta Porcupine Mines Inc. 243
Newmont Exploration of Canada Limited 244
New Texmont Explorations Ltd. 244
Noranda Exploration Company, Limited 244
Pamorex Minerals Inc. 244
Night Hawk Project 244
Placer Dome Inc. 245
D.R. Pyke & Associates 245
Quote Resources Inc. 245
Rio Algom Limited 245
Seaview Resources 245
Stan North Mining Corp. 245
Tarzan Gold Inc. 245
Total Energold Corporation 245
Trader Resource Corp. 245
M.A. Tremblay 245
Ventex Energy Ltd. 245
Recommendations for Prospecting in the Timmins Area 245
Recommendations for Prospecting in the James Bay Lowland 246
Swayze Belt Exploration Activity 246
American Barrick Resources Corporation–Glen Auden Resources Limited–Goldrock Resources Incorporated 246
BHP–Utah Mines Ltd. 246
Black Gregor Explorations Ltd.–Carlson Mines Ltd. 246
B.P. Canada Inc. 247
Central Crude Limited–Noront Resources Ltd. 247
Chester Minerals Limited 247
Cominco Ltd. 247
Glen Roy Resources Inc. 247
Gold Bar Resources Inc.–Murgold Resources Inc. 247
Golden Dragon Resources Ltd. 247
Grand American Minerals Limited 247
Hanson Lake Resources Limited 247
Jarvis Resources Ltd. 247
Kirkton Resources Limited 247
Landers Property 248
Macjo Resources Limited 248
Noranda Exploration Company, Limited 248
Patrie Property 248
Pelangio–Larder Mines Ltd.–Bayridge Developments Inc. 248
Tarzan Gold Inc.–Noranda Exploration Company, Limited 248
Tarzan Gold Inc. 248
Teck Corporation 249
Timmins Nickel Incorporated–Gold Bar Resources Inc. 249
M. Tremblay 249

Recommendations for Prospecting in the Swayze Area 249
  Gold 249
  Base Metals 249
  Industrial Minerals 250
Resident Geologist's Staff Activities 251
Timmins Drill Core Library Program 251
Ontario Geological Survey Activities 252
    Project 89-13: Geological Studies in the Manitouwadge-Hornepayne Area. 252
    Project 89-06: The Geological Setting of Gold Mineralization in the Horwood Lake Area of the Swayze Belt. 252
    Project 89-11: Geology of the Kamiskotia Area, Abitibi Subprovince. . 252
    Program 4: Site Survey for Continental Drilling in the Kapuskasing Structural Zone. 252
    Project 89-48,-49: Recent Airborne Electromagnetic-Magnetic Surveys in Northern Ontario. 252
Research by Other Agencies 252
  Geological Survey of Canada 252
Selected Publications Received, 1989 253
Selected References 254

TABLES

12.1. Exploration Activity During the Year. 224

12.2. Summary of Claims Recorded and Assessment Work Credit. 227

12.3. Gold Production from the Timmins Resident Geologist's District (to the end of 1988). 230

12.4. Base Metal Production from the Timmins Resident Geologist's District (to the end of 1988). 231

12.5. Industrial Mineral Production from the Timmins Resident Geologist's District 1989. 234

12.6. Maps and Reports Pertaining to the Timmins Resident Geologist's District, Issued by the Ontario Geological Survey in 1989. 253

FIGURES

12.1a. Timmins Resident Geologist's District 218

12.1b. Timmins Resident Geologist's District 219

12.1c. Timmins Resident Geologist's District 220

12.1d. Timmins Resident Geologist's District 221

12.1e. Timmins Resident Geologist's District 222

12.1f. Timmins Resident Geologist's District 223

12.2. Timmins Resident Geologist's District 228

13. KIRKLAND LAKE RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 255
Mining Activity 255
    American Barrick Resources Corporation 255
    Canamax Resources Inc. 256
    Dofasco Inc. 256
    Eastmaque Gold Mines Ltd. 256
    Extender Minerals of Canada Ltd. 256

- Giant Yellowknife Mines Ltd.–Preston Electrical & Mechanical Ltd. 256
- Golden Shield Resources Ltd. 257
- Hedman Resources Ltd. 258
- LAC Minerals Ltd. 258
- Mining Corporation of Canada Ltd. 258

Advanced Exploration And Development 258
- Armistice Resources Ltd.–GSR Acquisition Corporation 258
- Northfield Minerals Inc.–Rockford Minerals Inc. 258
- Goldpost Resources Inc. 259
- Inco Gold Company 259
- LAC Minerals Ltd.–Jonpol Explorations Ltd.–T & H Resources Ltd. 259
- Perrex Resources Inc.–Alberta Gold Exploration Corp. 259

Exploration Activities 259
- Battle Mountain (Canada) Inc.–HSK Minerals Ltd. 259
- Callahan Mining Corp.–Shenandoah Resources Ltd.–Miller Independence Mining Company Ltd.–Nortek Minerals Ltd. 259
- Chevron Canada Resources Ltd.–Stroud Resources Ltd. 259
- Cogema Canada Ltd.–Ameritex Resources Ltd. 259
- Goldteck Mines Ltd.–Matachewan Consolidated Mines Ltd. 260
- HSK Minerals Ltd.–Strike Minerals Inc. 260
- Joutel Resources Ltd.–Mountain Lake Resources Inc. 260
- Noranda Inc.–Alban Explorations Ltd.–Matachewan Consolidated Mines Ltd. 260
- Noranda Inc.–Destiny Resources Ltd. 260
- Noranda Inc.–Glimmer Resources Inc. 260
- Noranda Inc.–Freewest Resources Inc. 260
- Noranda Inc.–Freewest Resources Inc.–Newmont Exploration of Canada Ltd.–Teddy Bear Valley Mines Ltd. 260
- Noranda Inc.–Lightval Mines Ltd.–Newmont Mining Corp. 260
- Silverside Resources Inc. 260
- Tarzan Gold Inc.–Glen Auden Resources Ltd. 261
- Tundra Gold Mines Ltd. 261
- Unocal Canada Ltd.–Moneta Porcupine Mines Inc.–Nahanni Mines Ltd. 261

Resident Geologist Staff Activities 261
- Drill Core Storage Program 269
- Matachewan-Kirkland Lake-Larder Lake Gold Study 269
- Stream Sediment and Water Geochemical Survey 269

Recommendations for Base Metal Exploration 271

Ontario Geological Survey Activities 271
- Precambrian Geology Section 271
- Geophysics/Geochemistry Section 271

Research by Other Agencies 271
- Universities 271
  - Queen's University 271
  - University of Toronto 271
  - Technische Universitaet Berlin (West Germany) 272

References 272

TABLES

13.1. Summary of Claims Recorded and Assessment Work Credit. 256

13.2. Past Gold Production in the Kirkland Lake Resident Geologist's District (to the end of 1988). 257

13.3. Exploration Activity During the Year. 265

13.4. Summary of Core Collected since November 1, 1988. 271

FIGURES

13.1. Kirkland Lake Resident Geologist's District 262
13.2. Kirkland Lake Resident Geologist's District 264
13.3. Kirkland Lake Resident Geologist's District 270

14. COBALT RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 273
Mining Activity 273
    Beaver–Temiskaming Mine (Agnico–Eagle Mines Limited) 273
    Sherman Mine (Dofasco Inc. and Tetapaga Mining Company Limited) 274
    Bucke Quarry (Dymond Clay Products Limited) 274
    McLaren's Bay Mica Stone Quarries (G. Boughner) 275
    Thorne Brilliant Stone Quarry (P. Pharand) 275
Mills and Refineries 275
    Penn Mill (Agnico–Eagle Mines Limited) 275
    Agnico–Eagle Silver Refinery (Agnico–Eagle Mines Limited) 275
    Cobalt Refinery (Cobalt Refinery Limited) 275
Advanced Exploration and Development 276
    Penna Mine (Agnico–Eagle Mines Limited) 276
    Upper Bonsall Mine (Sandy K Mines Limited–NLX Resources Inc.) . 277
    Leroy Shaft (Agnico–Eagle Mines Limited) 277
    Kanichee Mine (Northern Platinum Ltd.–Northern Management and Consultants Limited) 277
Exploration Activity 277
  Cobalt Area 279
  Englehart Area 279
  Shining Tree Area 284
  Gowganda–Elk Lake Area 285
  Temagami Area 285
  North Bay Area 285
Resident Geologist's Staff Activities 285
  Hazard Lands Abatement Program 287
  Miscellaneous Hazards 288
Research by Resident Office Staff 288
  Geology and Mineral Potential of Banting Township and the Western Part of Best Township 288
  Geological Data Inventory Folio (GDIF) Compilation 290
  Temagami–Temiskaming Mine Compilation Project 290
Diamond-drill Core Storage Program 292
Recommendations for Exploration 292
Ontario Geological Survey Activities 293
  Geophysics/Geochemistry Section 293
  Precambrian Geology Section 293
  Engineering and Terrain Geology Section 293
  Geoscience Laboratories Section 294
Research by Other Agencies 294
  Carleton University 294
  Laurentian University 294
  McMaster University 294
  University of Ottawa 294
  University of Western Ontario 294

Selected Publications Received 294
References 296

TABLES

14.1. Exploration Activity During the Year. 278
14.2. Maps and Reports Pertaining to the Cobalt Resident Geologist's District Published During this Year by the Ontario Geological Survey. . 283
14.3. Summary of Drill Core Stored in the Cobalt Drill Core Library. 293

FIGURES

14.1a. Cobalt Resident Geologist's District 280
14.1b. Cobalt Resident Geologist's District 282
14.1c. Cobalt Resident Geologist's District 282
14.2. Exploration Diamond-drilling Activity in the Cobalt Resident Geologist's District. 283

15. SUDBURY RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 299
Mining Activities 299
  The Price of Nickel 299
  Company News 299
  Nickel-Copper-Precious Metals Mining 300
  The Trucking Issue 300
  Gold Mining 300
  Industrial Minerals Production 301
Exploration Activities 301
    Falconbridge Limited 301
    Inco Limited 301
    BP Canada Inc. 301
    Flag Resources (1985) Ltd. 301
    Stralak Resources Inc. 303
    Rainbow Exploration Corp. 303
    Placer Dome Inc. 303
    Sangreal Mining Company Limited 303
    Augdome Corporation Limited 303
    La Society De Gestion Maskouse Inc. 305
    R. Sivard 305
    J. Owen 305
    C. Fielding 305
    H. Tracanelli 305
    G. Salo 306
Resident Geologist's Staff and Activities 306
  Staff 306
  Activities 306
Projects 307
  Sudbury Mineral Occurrence Study 307
    Wolf Lake 308
    Parkin Township Calcite 308
  Sudbury Building Stone Study 309
  Geological Data Inventory Folios 310
Lithoprobe and Canadian Continental Drilling Program 310
Ontario Geological Survey Activities 310
Research by Other Agencies 310
Ontario Mineral Exploration Program (OMEP) 310
Selected Publications Received 310
Reference 311

TABLES

15.1. Exploration Activity During the Year. 304

15.2. Summary of Claims Recorded and Assessment Work Credit. 305

FIGURES

15.1. Sudbury Resident Geologist's District 302
15.2. Producing Mines and Commodities, Sudbury Mining Camp. 303

16. SOUTHERN REGION

Introduction 313

17. ALGONQUIN RESIDENT GEOLOGIST'S DISTRICT–1989

Introduction 315
Mining Activity 315
Advanced Exploration and Development 315
- Cal Graphite Corporation 315
- North Coast Industries Limited 315

Exploration Activity 315
- Platinum Group and Precious Metals 315
- Gold 316
- Vanadium-Titanium-Magnetite 316
- Quartz 316
- Stone 316

Resident Geologist's Staff Activities 316
Property Examinations 317
- Armour Township Copper-Nickel Occurrence 317
- McClintock Township Nickel Occurrence 317
- Brunel Township Copper-Nickel Occurrence 317
- Maria Township Graphite 318
- Cal Graphite Corp. Butt Township Graphite Deposit 318
- Chapman Township Amazonite 318
- The McGown Mine, Foley Township 318
- The Wilcox Copper Mine 318
- The Bayshore Copper-Zinc Prospect 318
- Consolidated Copper Company, Spider Lake 318
- Richmond Lake Occurrence 319
- Rinky Dink Mine 319

Research by Resident Geologist's Office Staff 319
- Geology and Economic Potential of the Base and Precious Metal Occurrences in the Parry Sound–Huntsville Area, Grenville Province 319
  - Introduction 319
  - Mineral Exploration 319
  - Geology 319
  - Current Work 319
- Industrial Minerals and Building Stone 319
  - Flagstone 321

Recommendations for Exploration 321
Research by Other Agencies 321
- Geological Survey of Canada 321
- Universities 321

Selected Publications Received 321
References 322

TABLES

17.1. Exploration Activity During the Year. 316

17.2. Summary of Claims Recorded and Assessment Work Credit. 316

FIGURE

17.1 Algonquin Resident Geologist's District 320

18. SOUTHEASTERN RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 323
Mining Activity 323
Advanced Exploration and Development 323
Exploration Activity 323
  Gold Exploration 326
  Industrial Minerals Exploration 326
Resident Geologist's Staff Activities 330
  Services 330
  Staffing 330
  Activities 330
Research by Resident Office Staff 331
  Building Stone (COMDA) 331
  Refractory Minerals (COMDA) 331
  Industrial Minerals (COMDA) 331
  Geology and Geophysics of Fluorite Deposits 331
Diamond-drill Core Storage Program 331
  Tweed Drill Core Library 331
  Bancroft Drill Core Library 333
Recommendations for Exploration 333
  Base Metals 333
  Industrial Minerals 334
Ontario Geological Survey Activities 334
References 334

TABLES

18.1. Mining Activity 1989. 325
18.2. Exploration Activity 1989. 328
18.3. Summary of Claims Recorded and Assessment Work Credited, Southern Ontario Mining Division. 329
18.4. Summary of Tweed Core Library Holdings, December 1, 1989. 332
18.5. Summary of Bancroft Core Library Holdings. 333
18.6. Mines and Minerals Division, Ministry of Northern Development and Mines, and Geological Survey of Canada Publications Relating to Southeastern District Released in 1989. 335

FIGURES

18.1. Operating Mines and Mills 1989 324
18.2. Active Exploration Sites 1989 327

19. SOUTHWESTERN RESIDENT GEOLOGIST'S DISTRICT—1989

Introduction 337
Mining Activities 337
  Salt 337

Gypsum 337
Building Stone 337
Resident Geologist's Activities 337
Ontario Geological Survey Activities 340
Research by Other Agencies 340
Ontario Geoscience Research Grant Program 340
Selected Publications Received 340

FIGURE

19.1. Southwestern Resident Geologist's District 338

20. PETROLEUM RESOURCES SECTION, MINISTRY OF NATURAL RESOURCES – 1989

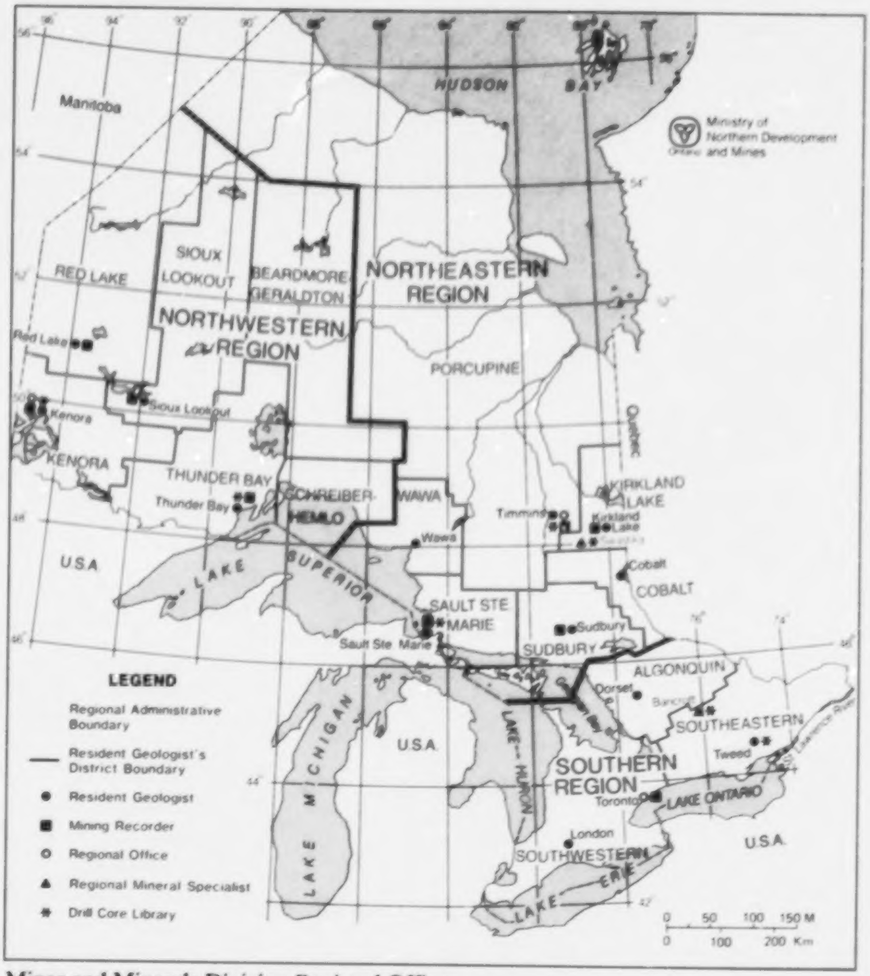
Introduction 341
Oil and Gas Production 341
Exploration and Development Activity 341
Staff Activities 343
Drill Sample Storage 344
Recommendations for Exploration 344
Research by Other Agencies 345
References 345

TABLE

20.1. Successful Exploratory Wells in Southwestern Ontario, 1989. 343

FIGURE

20.1. Ministry of Natural Resources Petroleum Resources Section. 342


HUDSON BAY
Manitoba
Ministry of Northern Development and Mines
Ontario
RED LAKE
SIOUX LOOKOUT
BEARDMORE GERALDTON
NORTHEASTERN REGION
NORTHWESTERN REGION
PORCUPINE
Red Lake
Sioux Lookout
Kenora
KENORA
Quebec
THUNDER BAY
Thunder Bay
SCHREIBER
HEMLO
WAWA
Wawa
Timmins
KIRKLAND LAKE
Kirkland Lake
Swastika
Cobalt
COBALT
U.S.A.
LAKE SUPERIOR
SAULT STE MARIE
Sault Ste Marie
Sudbury
SUDBURY
ALGONQUIN
Dorset
Bancroft
SOUTHEASTERN
Tweed
St. Lawrence River
LAKE MICHIGAN
U.S.A.
LAKE HURON
SOUTHERN REGION
Toronto
LAKE ONTARIO
London
SOUTHWESTERN
LAKE ERIE
U.S.A.
LEGEND
Regional Administrative Boundary
Resident Geologist's District Boundary
● Resident Geologist
■ Mining Recorder
○ Regional Office
▲ Regional Mineral Specialist
* Drill Core Library
0 50 100 150 M
0 100 200 Km

Mines and Minerals Division Regional Offices

CITY	OFFICE(S)	ADDRESS	TELEPHONE	FAX
Kenora	○	Box 5050, 12 Main St. S. P9N 3X9	(807) 468-3135	(807) 468-6298
	●	Box 5200, 808 Robertson St. P9N 3X9	(807) 468-3658	(807) 468-9451
	■	Box 5200, 808 Robertson St. P9N 3X9	(807) 468-8492	(807) 468-9451
	*	860 Fourth Ave. S. P9N 2A1	(807) 468-3658	—
Red Lake	●	Box 324, Ont. Govt. Bldg. P0V 2M0	(807) 727-3272	(807) 727-3553
	■	Box 324, Ont. Govt. Bldg. P0V 2M0	(807) 727-3284	(807) 727-3553
Sioux Lookout	●	Box 3000, OPP Bldg. P0V 2T0	(807) 737-2039	(807) 737-1727
	■	Box 3000, OPP Bldg. P0V 2T0	(807) 737-2034	(807) 737-1727
Thunder Bay	● (3)	435 James St. S. P7E 6E3	(807) 475-1331	(807) 475-5312
	■	435 James St. S. P7E 6E3	(807) 475-1311	(807) 475-5312
	*	335 Euclid Ave. P7E 6G6	(807) 475-1331	—
Wawa	●	Box 530, Mine Rd. P0S 1K0	(705) 856-4883	(705) 856-4282
Sault Ste. Marie	● ■	875 Queen St. E. P6A 2B3	(705) 949-1231	(705) 949-0014
	*	64 Church St. P6A 5L5	(705) 949-1231	—
Timmins	○ ● ■	60 Wilson Ave. P4N 2S7	(705) 267-1401	(705) 264-8723
	*	896 Riverside Dr. P4N 3W2	(705) 267-1401	—
Kirkland Lake	●	4 Government Rd. E. P2N 1A2	(705) 567-5242	(705) 567-5621
	■	4 Government Rd. E. P2N 1A2	(705) 567-9242	(705) 567-5621
Swastika	▲ *	Box 129 P0K 1T0	(705) 642-3222	(705) 642-3323
Cobalt	●	Box 230, Presley St. P0J 1C0	(705) 679-8558	(705) 679-5584
Sudbury	● ■	6th floor, 200 Brady St. P3A 5W2	(705) 675-4441	(705) 675-6473
Dorset	●	Box 190 P0A 1E0	(705) 766-2494	(705) 766-9976
Tweed	● *	B.S. 43, Old Troy Rd. K0K 3J0	(613) 478-2330	(613) 478-6247
Bancroft	▲ *	Box 3000, Highway 28 K0L 1C0	(613) 332-4875	—
Toronto	■	1st floor, 10 Wellesley St. E. M4Y 1G2	(416) 965-1322	(416) 963-0257
	○	1st floor, 10 Wellesley St. E. M4Y 1G2	(416) 965-3611	(416) 963-0257
London	●	Box 5463, 659 Exeter Rd. N6A 4L6	(519) 661-2773	(519) 661-2819

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

1. Northwestern Region Introduction

K.G. Fenwick

Manager, Mineral Resources, Northwestern Region.

The Northwestern Region of the Mines and Minerals Division is made up of six Resident Geologists' districts and four Mining Divisions which are the Thunder Bay, Red Lake, Patricia and Kenora mining divisions. The region is approximately 700 by 700 km in size.

The goal of the Regional Mineral Resources Program is to stimulate and monitor exploration, development and production of the mineral resources in the region. This is done by the six Resident Geologist programs which cover the Red Lake, Sioux Lookout, Kenora, Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo districts; the Industrial Minerals program that covers the entire region; the Drill Core Library program which is composed of two libraries, one in Kenora and the other in Thunder Bay; the Historical Research program; the Mineral Commodity Geologist program which covers the Dryden area; and the Geological Data Inventory Folio program for the Kenora and Sioux Lookout districts.

The Resident Geologist programs provided a professional consultative service, and advice in the office and in the field, to the prospectors, the exploration companies and the public on the geology, the mineral deposits, and the exploration and mining activities in the region. In 1989, over 5000 office consultations were provided to their clientele. The regional Mines and Minerals staff made over 300 field visits to exploration and mining sites. The Resident Geologists' general duties also included the provision of technical information and recommendations to other government agencies (Ministry of Natural Resources, Ministry of the Environment, Ministry of Labour) on land use matters.

Basic prospecting courses were conducted in Red Lake, Kenora, Sioux Lookout, Marathon and Thunder Bay. An advanced prospecting course was held in Beardmore. Finally, an advanced base metal prospecting course was run in Manitouwadge. Posters, depicting the exploration and mining activities in the six Resident Geologists' districts and in Industrial Minerals in the Northwestern Region, were put on display at the two Mines and Minerals Symposia in Toronto and Thunder Bay. A corporate poster, depicting the exploration and mining activities in the entire region, was presented at the Institute on Lake Superior Geology Annual Meeting, in Duluth, Minnesota; at the 1989 Current Activities Forum of the Minnesota Department of Natural Resources, in Chisholm, Minnesota; and at the Northeastern Ontario Mines and Minerals Symposium in Timmins.

Reports were started or continued on research into, and field visits to, the mineral occurrences in the Birch–Confederation lakes area, the Schreiber–Terrace Bay area, the Manitouwadge–Marathon–Hemlo area, the Fort Hope–Miminiska Lake area, the Manitou–Stormy lakes area, and the North Caribou and Central Uchi metavolcanic belts. Satellite field offices were maintained in Beardmore, Geraldton and Marathon, and a summer office was maintained in Pickle Lake.

The Historical Research, the Mineral Commodity Geologist and the Geological Data Inventory Folio programs were funded by the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement of the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. These programs all terminate on March 31, 1990. In 1989, the Historical Research program researched *The Northern Miner* from January 1946 through December 1948, for articles on mineral occurrences and prospects in the Beardmore–Geraldton area. These articles were added to the Beardmore–Geraldton Mineral Deposit files. Several unstaked occurrences were identified through this program and were subsequently staked by explorationists who researched our files.

The staff of the Thunder Bay Drill Core Library collected 10300 m of diamond-drill core from 30 occurrences, prospects and mines in the Thunder Bay Mining

Division during 1989. The staff from the Kenora Drill Core Library collected, from November 21, 1988 to November 23, 1989, 23461.9 m of core: 7646.4 m from Sioux Lookout District; 6481.6 m from Kenora District; and 9333.9 m from Red Lake District. Much of the core in this library is from recent gold exploration, although some emphasis has been placed on collecting core from the more remote parts of the region and from old mine sites.

Exploration activity in the Northwestern Region in 1989 was approximately 65 percent of the activity in 1988. The decline is the result of a reduced number of active junior mining companies. Gold exploration accounted for more than 80 percent of this activity. In all, there were over 350 active exploration programs in the region in 1989. Of these, 22 were in the advanced exploration stage, with 9 of them being underground.

It has been another excellent year for production of gold in the Northwestern Region. The combined production from the seven operations: the Golden Giant, the David Bell, the Williams, the Golden Patricia, the Campbell Red Lake, the Arthur W. White and Dona Lake mines was over 1.5 million ounces of gold. This amount represents two-thirds of Ontario's and one-third of the nation's gold production. The Dona Lake Mine of Placer Dome Inc. started up in the spring of 1989 and is now in full production. Ateba Mines Inc.'s 200 ton per day mill at Beardmore reopened for milling in December 1989. Extensive renovation of the mill components was undertaken for most of the year.

Four base metal mines, the Lyon Lake, the Winston Lake, the Geco and the Shebandowan mines, were in production during the year. The rise in base metal prices prompted INCO Limited to reopen its Shebandowan nickel-copper mine in January 1989.

Four granite dimension stone quarries, two pink, one grey and one yellow, were in production. Active mining at seven amethyst deposits, northeast of Thunder Bay, continued on a seasonal basis. Other industrial minerals produced in the region include white quartz and diabase, and a small quantity of soapstone.

2. Kenora Resident Geologist's District—1989

C.E. Blackburn[1], M.R. Hallstone[2], P.-C. Delisle[3] and C.C. Storey[4]

[1]Resident Geologist, Kenora Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Kenora Resident Geologist's Office, Northwestern Region.

[3]Project Geologist, Kenora Resident Geologist's Office, Northwestern Region.

[4]Drill Core Library Geologist, Kenora Drill Core Library, Northwestern Region.

INTRODUCTION

Compared with 1988, exploration activity in the Kenora Resident Geologist's District was down in 1989, with 74 projects by prospectors and mineral exploration companies underway. Sixty-two of these projects were for gold, compared with about 100 in 1988. Advanced exploration, with underground development, was conducted on one property only, the Nuinsco Resources Ltd.–Deak Resources Corporation joint venture gold operation at Cameron Lake. No further underground work was done at either Consolidated Professor Mines Limited's Duport gold mine property at Shoal Lake, or at Boise Cascade Canada Ltd.'s wholly owned Scramble mine gold property 10 km northeast of Kenora. Exploration was also conducted in the district for base metals and dimension stone. Interest in platinum group metals fell off sharply with no programs active, compared with three the previous year.

Production of pink dimension stone by Nelson Granite and by Granite Quarriers (G.Q.I.) Incorporated continued at two quarries, both in Docker Township, near Vermilion Bay. In addition, Nelson Granite produced grey dimension stone from a long-dormant quarry in Bradshaw Township, west of Ignace. Canital Granite Ltd. produced yellow dimension stone from a new quarry located near Forgotten Lake, north of Kenora. Crystal Quarries Limited continued to produce white quartz decorative stone from a quarry south of Vermilion Bay.

From the Kenora Resident Geologist's office, the final year of a three-year Mineral Commodity Geologist program for the Dryden area, and the final year of a four-year program to produce Geological Data Inventory Folios (GDIFs) were undertaken. Both of these programs were part of the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. Ongoing programs from the Kenora office included acquisition of exploration diamond-drill core from the Kenora, Red Lake and Patricia mining divisions, monitoring of exploration activity, and provision of geoscience information and professional advice to mineral explorationists.

MINING ACTIVITY

There was no precious or base metal production from mining in the Kenora Resident Geologist's District in 1988, other than the small amount noted under the section Small-scale Mining.

DIMENSION STONE

Production of granite dimension stone continued at two quarries in Docker Township, and commenced at one quarry in Bradshaw Township and at another quarry near Forgotten Lake. Pink stone was quarried at the former two quarries, adjacent to Trans-Canada Highway 17, 12 km west of Vermilion Bay. One of these quarries, owned by Nelson Granite, a division of Nelson Monuments Limited, Sussex, New Brunswick, operated throughout 1989. Most of the stone from this quarry was shipped as rough blocks to eastern Canada, and to various destinations in the United States, for monumental and architectural applications. The other quarry, owned by Granite Quarriers (G.Q.I.) Incorporated, of Beebe, Quebec, operated for part of 1989. The blocks from this quarry were shipped to eastern Canada and the United States for processing as monumental and architectural stone.

Grey stone was quarried near Butler, in Bradshaw Township, adjacent to the Trans-Canada Highway. Production from this quarry, amounting to approximately 260 m^3 or 8000 cubic feet (C. Nelson, Nelson Granite, Vermilion Bay, personal communication, 1989) was to be used for cladding a new Ontario Provincial Government building in Thunder Bay.

Yellow granite dimension stone was produced by Canital Granite Ltd., from a quarry adjacent to the English River road, north of Redditt.

DECORATIVE STONE

Crystal Quarries Limited continued to extract white quartz from a vein located adjacent to a forest access road about 30 km due south of Vermilion Bay, for use as exposed aggregate in precast concrete panels.

SMALL-SCALE MINING

A. Kozowy (prospector, Dryden) continued production, which commenced in 1988, from his Flambeau Lake prospect, close to Dryden in Van Horne Township. The mill produced approximately 30 ounces of gold in 1989 (A. Kozowy, Prospector, personal communication, 1989), compared to 100 ounces in 1988.

ADVANCED EXPLORATION AND DEVELOPMENT

At year end, two underground operations, those of Consolidated Professor Mines Limited at Shoal Lake, and of Nuinsco Resources Ltd.–Deak Resources Corporation at Cameron Lake, were poised at the production decision stage, pending financing and other considerations. Production at both is contingent on the stabilization of gold prices, the former reporting to require a price in excess of US$400, and the latter a price of US$360 to be viable. The latter is based on new exploration done in 1989 and new reserve calculations: a previous feasibility study in 1988 had indicated that viability depended on a price of at least US$550.

Consolidated Professor Mines Limited, Shoal Lake

Underground exploration was completed at the Duport mine, the Shoal Lake gold property of Consolidated Professor Mines Limited, in 1987, and no further exploration has been conducted since that time. Geological reserves at the Duport mine stand at 2 million tons averaging 0.35 ounce gold per ton. Following feasibility studies, Consolidated Professor's mine development plan calls for floatation milling of 450 t of ore per day on Stevens Island, the concentrate being taken to a mainland plant for further treatment and recovery of gold. Preproduction capital costs of $52.9 million are estimated.

The first of a number of required applications for environmental approval were submitted to the Ontario Ministry of the Environment in May. At the end of August, the company announced in a press release that the Duport project had been designated for review under the Environmental Assessment Act.

Nuinsco Resources Ltd.–Deak Resources Corporation, Cameron Lake

Prior to 1989, underground exploration at the Cameron Lake property by Nuinsco Resources Ltd. and former joint venture partner Echo Bay Mines Limited had led to a feasibility study indicating mineable reserves of 788000 tons grading 0.194 ounce gold per ton. In November of 1988, Echo Bay and Nuinsco announced that the former's controlling 53.8 percent interest in the latter would be sold to Deak Resources Corporation, and that Deak Resources, in a separate transaction, would purchase shares in Nuinsco Resources Ltd., the proceeds to be used to continue development at the Cameron Lake property.

Nuinsco Resources Ltd. announced in a January 25, 1989, press release that a complete review of all technical data and new ore reserve calculations by consultant D.R. Melling yielded total probable and possible fully diluted mining reserves of 924500 tons grading 0.162 ounce gold per ton above the 800-foot level. Of this total, 82 percent of the reserves were indicated to occur between the 300- and 800-foot levels. Previous deep drilling had indicated the deposit to be open to depth below the 800-foot level to in excess of 1000 feet. Dynatec Mining Ltd. was in the process of extending the existing ramp from the 685- to the 835-foot level, and surface diamond drilling was resumed. Two drill rigs were testing the depth extension of the deposit to the 2000-foot level, and two drill rigs were exploring the west extension of the structure hosting the "Main" deposit. Financing for the work came from a $1 million flow-through share offering.

In a February 16, 1989, press release, Nuinsco announced that four surface diamond-drill holes had been completed to depths from 1300 to 1700 feet, and that all four holes had intersected the Cameron Lake shear zone. Intersections ranged from 10.5 feet grading 0.23 ounce gold per ton to 36 feet averaging 0.12 ounce gold per ton.

In a May 30, 1989, press release, Nuinsco announced new ore reserve calculations based on results of its recently completed surface and underground exploration programs, and using a cutoff grade of 0.08 ounce gold per ton to prove up a lower grade, higher tonnage deposit. From surface to the 1000-foot level, total proven and probable reserves were calculated at 1105261 tons grading 0.181 ounce gold per ton, and further reserves in the "possible" category, from 1000 feet down to 2600 feet, were calculated at 2054887 tons grading 0.168 ounce gold per ton, for a total of 3160148 tons grading 0.168 ounce gold per ton, for a total estimated yield of 530253 ounces of gold. Preproduction capital costs, based on a 1000 ton per day mill, were estimated at $23.8 million.

Boise Cascade Canada Ltd.

No further underground development was done at Boise Cascade Canada Ltd.'s wholly owned Scramble mine gold property 10 km northeast of Kenora. Development in 1988 in a joint venture with Madeleine Mines Ltd. as operator had consisted of the excavation of a decline ramp and drift along the ore zone at the 300-foot level toward the old shaft, excavation of a shallow sublevel beneath the ramp, and the stockpiling of development muck on-site. In 1989, 3200 feet of surface diamond drilling was done in six holes, to test the strike extension of the ore zone in the ramp area (B. Guarnera, Boise Cascade Canada Ltd., personal communication, 1989).

EXPLORATION ACTIVITY

Despite the marked downturn in the price of gold below the US$400 level, gold remained the commodity most sought after, with 62 out of the 74 exploration and prospecting projects listed in Table 2.2 directed at its assessment. The predicted future shortfall in base metal inventories, due to exploration efforts having been directed at gold over the past half decade, has led to a slight increase in activity for these metals. Interest in platinum group metals fell off sharply, with no new pro-

TABLE 2.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	2 875	3 370	12 375	56 599	103 573	11 359	205 619
1988	3 531	2 639	12 694	119 947	267 990	16 957	443 554
1987	5 211	2 578	12 496	86 321	153 077	12 067	251 465
1986	4 041	5 054	9 863	64 099	47 883	9 698	144 837
1985	2 216	5 195	10 875	55 090	185 148	29 765	292 729
1984	3 261	3 042	13 854	36 055	281 359	23 670	364 692
1983	11 061	1 472	13 635	35 746	42 221	12 006	106 397
1982	1 579	1 609	4 046	23 525	26 270	5 330	68 439
1981	2 121	846	4 076	26 127	37 624	3 383	72 732
1980	1 877	788	3 208	15 428	3 149	859	21 368
1979	984	1 357	2 119	9 992	10 658	1 420	24 182
1978	808	1 357	2 300	22 299	7 576	2 143	34 934
1977	1 495	1 585	2 820	15 405	11 366	1 760	33 838
1976	1 380	2 125	3 234	25 030	21 367	5 960	55 042
1975	1 677	2 452	3 975	23 584	31 509	940	57 266
1974	2 653	1 076	4 727	29 496	18 049	3 070	52 134

grams started, and previous programs at Entwine Lake, Mulcahy Lake and in the Rex–Werner lakes area were either dormant or abandoned. Interest in stone products continued, within both the Winnipeg River Subprovince, and in the Wabigoon Subprovince (*see* Gerow and Bellinger, this volume).

GOLD

The search for gold continued in the four major gold-bearing areas that have enjoyed most of the exploration interest in the district since about 1983: Lake of the Woods–Shoal Lake; Kakagi–Rowan–Pipestone lakes; Manitou–Wabigoon–Eagle lakes; and Fort Frances–Mine Centre. In the latter area, emphasis shifted somewhat to the Lake Agassiz lowlands west of Fort Frances, where geological mapping of surficial deposits and overburden drilling studies by the Ontario Geological Survey has led to a new interest in the gold potential of the drift-covered bedrock. The interest in the Umfreville–Treelined lakes area north of Kenora that began in 1988 continued, but the Bee–Eagle lakes belt in the extreme northwest of the district was inactive.

Lake of the Woods–Shoal Lake Area

Exploration for gold continued in the Lake of the Woods metavolcanic-metasedimentary belt, but the level of activity was considerably lower than in the past year, when 23 properties were under evaluation, compared to 16 in 1989. Activity continued to be concentrated at the west end of the belt, in proximity to the Duport deformation zone and the Crowduck Lake–Rush Bay lineament, following the success of Bond Gold Canada Inc. in delineating a mineralized zone at Bag Bay, Shoal Lake.

Bond Gold Canada Inc. continued its exploration at Shoal Lake, mostly on patented ground owned by joint venture partner Kenora Prospectors and Miners Limited that includes the past-producing Mikado and Cedar Island (Cornucopia) mines among other gold prospects. A 13 129-foot diamond-drill program conducted in the winter of 1988–1989 led to the calculation of increased drill-indicated reserves, reported in *The Northern Miner*, March 6, 1989, as 1 401 801 tons grading 0.25 ounce gold per ton. Ten of the 14 holes drilled tested the "Main" vein, the extension of the Cedar Island zone lying between the old Cedar Island and Mikado mines. The best intersections were reported to be 7.76 ounces gold over a true width of 6.43 feet in one hole, and 0.49 ounce gold over 16.99 feet in another hole. Drill-indicated reserves calculated for the "Main" vein were reported as 749 360 tons grading 0.26 ounce gold over an average true width of 8.39 feet. Four holes drilled in the vicinity of the old Mikado workings intersected the Mikado vein, and visible gold was found in core from two of them.

Golden Rule Resources Ltd. continued exploration in the Canoe Lake stock, where work to date, including diamond drilling of geophysical and geochemical targets, had concentrated on ground immediately adjacent to the Mikado gold property of Bond Gold Canada Inc. and Kenora Prospectors and Miners Limited. In 1989, an airborne magnetic and very low frequency electromagnetic (VLF-EM) survey was flown over a 203-claim group covering more than two-thirds of the Canoe Lake stock, and adjacent metavolcanics to the northeast. Numerous northwest-trending VLF-EM conductors were identified, spaced at regular intervals throughout the stock.

Exploration Brex Inc. and 162278 Canada Inc. conducted exploration on newly acquired ground along and

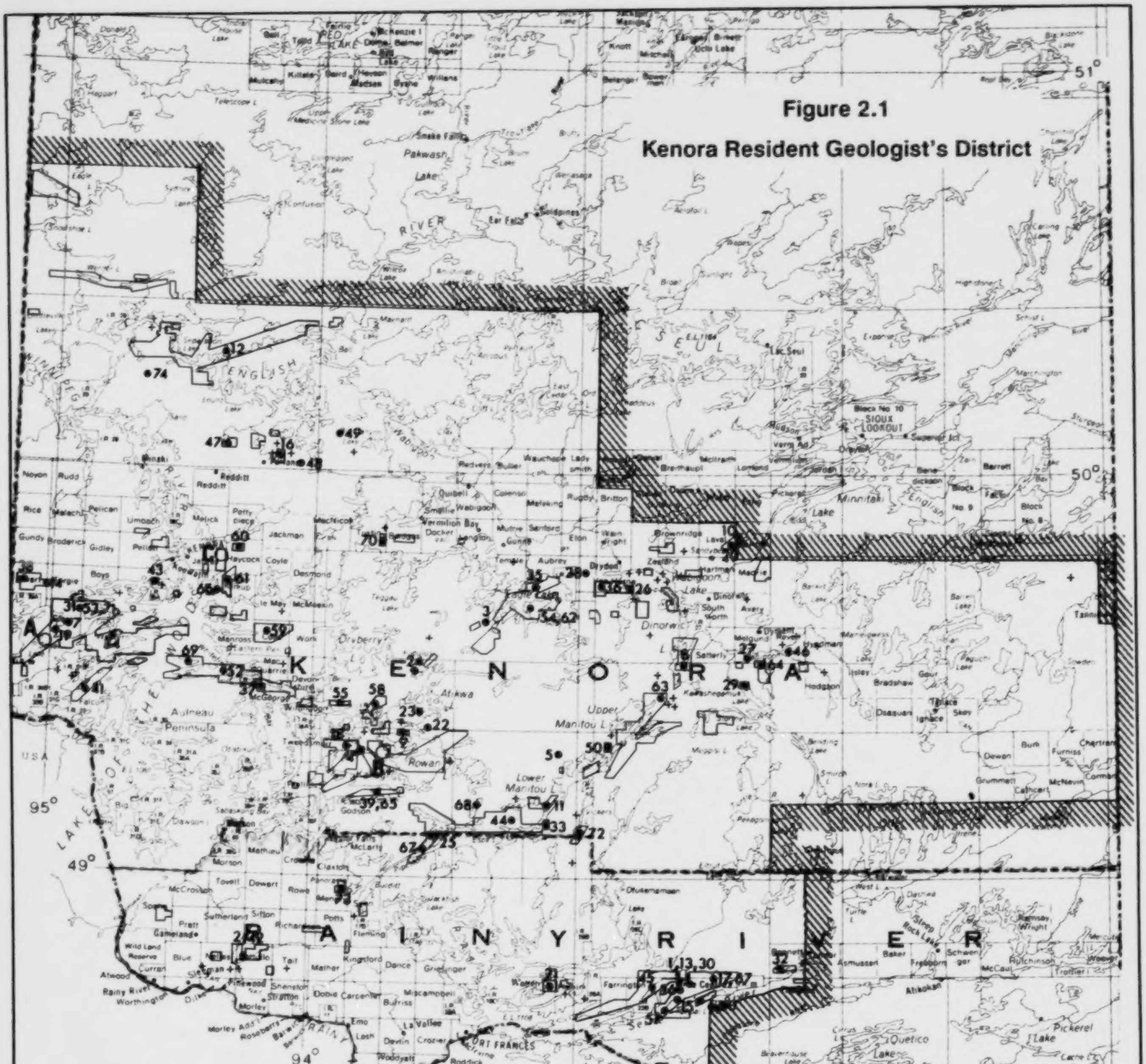


Figure 2.1

Kenora Resident Geologist's District

EXPLANATION
District Boundary
● Exploration Activity in 1989 (keyed to Table 2.2)
✦ Isolated active claims and claim blocks as of December 1, 1989
Extent of contiguous staking as of December 1, 1989 (may include patented claims in areas of intense staking)
○ Properties under advanced exploration and development
A. Consolidated Professor Mines Limited
B. Nuinsco Resources Ltd.-Deak Resources Corporation
C. Boise Cascade Canada Ltd.
Scale
0 25 mi
0 20 40 Km
51°
50°
49°
95°
94°
93°
92°
K E N O R A
R A I N Y R I V E R
USA
RED LAKE
Pakwash Lake
RIVER
ENGLISH
LAC SEUL
SIOUX LOOKOUT
Minnitaki Lake
Dryden
Dinorwic
Upper Manitou L.
Lower Manitou L.
Aulneau Peninsula
LAKE OF THE WOODS
Rainy River
FORT FRANCES
RAINY RIVER
RAINY LAKE
Atikokan
Quetico Lake
La Croix
Basswood Lake
Agnes Lake
Pickerel Lake
Ignace

TABLE 2.2. EXPLORATION ACTIVITY DURING THE YEAR.

AEM - Airborne electromagnetic survey
AMag - Airborne magnetometer survey
BS - Beneficiation studies
DD - Diamond drilling
EM - Electromagnetic survey
Geochem - Geochemical survey
Geophys - Geophysical survey
Geo R - Geological report
GL - Geological survey
IP - Induced polarization survey
Mag - Magnetometer survey
OVD - Overburden drilling
SA - Sampling and assaying
STr - Power stripping and manual stripping
Tr - Trenching

Number on Figure	Individual or Company	Activity	
1	Armstrong, George	Bad Vermilion Lake Area	DD, SA
2	Asarco Exploration Co. of Canada Ltd.	Nelles, Pattulo and Blue Townships	EM, Mag, DD, OVD
3	Barton, Bernard	Garnet Bay Area	STr, SA
4	BHP-Utah Mines Ltd.	Dogpaw Lake Area	GL, Geochem
5	Black Cliff Mines Ltd.	Barker Bay Area	Mag
6	Bolen, John A.	Bad Vermilion Lake Area	EM, Mag, GL, DD
7	Bond Gold Canada Inc.	Glass Township	DD, AEM, AMag
8	Bond Gold Canada Inc.	Turtlepond Lake Area	AEM, AMag
9	Caliban Resources Inc.	Rowan Lake Area	Geochem, Tr
10	Camreco Inc.	Laval Township	Geochem
11	Canhorn Mining Corporation	Napanee Lake Area	AEM, AMag
12	Champion Bear Resources Ltd.	Treelined Lake Area	AEM, AMag
13	Coldspring Resources Ltd.	Little Turtle Lake Area	STr
14	Consolidated Jalna Resources Ltd.	Ewart Township	DD
15	Cone, Russell Jr.	Bad Vermilion Lake Area	DD
16	Coppola, Ted	Wonderland Lake Area	BS, STr, Tr
17	Cousineau, Louis	Bad Vermilion Lake Area	Tr
18	Dunfrazier Gold Explorations Inc.	Dogpaw Lake Area	STr, Tr, SA
19	Exploration Brex Inc./162278 Canada Ltd.	Snowshoe Lake Area	DD, GL, Geophys, SA
20	Fairservice, Robert J.	Laval Township	SA
21	Falconbridge Limited	Watten Township	DD
22	Falconbridge Limited	Rowan Lake Area	EM, Mag
23	Falconbridge Limited	Atikwa Lake Area	EM, Mag
24	Falconbridge Limited	Fisher Lake Area	GL, Geochem, EM, Mag
25	Freewest Resources Inc.	Dash Lake Area	EM, Mag, IP
26	Glatz, A. and Burden, L.D.	Van Horne Township	EM, Mag
27	Glatz, A.	Melgund Township	EM, Mag
28	Glatz, A.	Aubrey Township	EM, Mag
29	Glatz, A.	Kawashegamuk Lake Area	STr
30	Gold Fields Canadian Mining Ltd.	Bad Vermilion Lake Area	AEM, AMag
31	Golden Rule Resources Ltd.	Shoal Lake Area and Glass Township	AEM, AMag
32	Gonzalez, D., and Pye, K.	Bennett Lake Area	AEM, AMag
33	Homestake Mineral Development Co.	Napanee Lake Area	EM, Mag, Geochem
34	Homestake Mineral Development Co.	Shoal Lake Area	EM, Mag
35	International Platinum Corp.	Buchan Bay Area	EM, DD
36	International Platinum Corp.	Van Horne Township	DD
37	Kuehnbaum, R.M., and Zebruck, G.	Aulneau Peninsula Area	GL
38	Martin, J.D.	Ewart Township	EM, Mag
39	Martin, Jack and Martin, Jason	Heronry Lake Area	EM
40	McCormick, Alan E.	Bad Vermilion Lake Area	DD
41	MCS Capital Ltd.	Monument Bay Area	AEM, AMag
42	Mingold Resources Inc.	Nelles, Pattullo, and Richardson Townships	OVD

TABLE 2.2. CONTINUED.

Number on Figure	Individual or Company	Activity	
43	Mingold Resources Inc.	Clearwater Bay Area	GL, Geochem, Geophys
44	Minnova Inc.	Bluffpoint Lake Area	DD
45	Minnova Inc.	Little Turtle Lake and Bliss Lake Areas	DD
46	Nelson, Carter	Revell Township	GL
47	Nelson, Carter	Forgotten Lake Area	GL, BS
48	Nelson, Carter	Wonderland Lake Area	BS, STr
49	Nelson, Carter	Kilgour Lake Area	STr
50	Nelson, Doug	Lower Manitou Lake Area	GL, Geochem
51	Nipigon Gold Resources Ltd.	Bad Vermilion Lake Area	STr, Tr
52	Noranda Exploration Co. Ltd.	Manross Township	EM, Mag, DD, GL, SA
53	Noranda Exploration Co. Ltd.	Glass Township	BS, Geochem, GL, DD
54	Noranda Exploration Co. Ltd.	Buchan Bay Area	DD
55	Noranda Exploration Co. Ltd.	Lobstick Bay Area	Geochem
56	P.I.R.P. Holdings Inc.	Bad Vermilion Lake Area	DD
57	Pitkanen, R.W.	Little Turtle Lake Area	STr, Tr
58	Placer Dome Inc.	Lobstick Bay Area	GL
59	Pogson, Gordon	Code Township	STr, Tr
60	Pogson, Gordon	Haycock Township	STr
61	President Mines Ltd.	Kirkup Township	DD
62	Raleigh Resources Ltd.	Buchan Bay Area	DD
63	Redden, J.W.	Boyer Lake Area	EM, Mag
64	Redden, J.W.	Tabor Lake Area	Geo R
65	Rio Algom Explorations Inc.	Heronry Lake and Brooks Lake Areas	GL, SA
66	Roberecki, Ed	Bigstone Bay Area	SA
67	Ross Island Resources Inc.	Dash Lake Area	DD, SA
68	Sande, David J.	Bluffpoint Lake Area	SA
69	Theriault, Rodrigues	Wiley Bay Area	GL
70	Thibault, Douglas	Tustin Township	STr, Geochem
71	Voyager Exploration Ltd.	Echo Bay Area	EM, Mag, DD, SA
72	Wellington Cove Explorations Ltd.	Mang Lake Area	GL, EM, Mag, IP, STr, Tr
73	Western Troy Capital Inc.	Menary Township	EM, Mag, Tr, GL, IP
74	Zebruck, George	Snook Lake Area	BS

adjacent to the Duport deformation zone. Three holes were diamond drilled, one immediately adjacent to the Duport gold property of Consolidated Professor Mines Limited, at the northeast end of Stevens Island, and two other holes along strike to the northeast, about 2 km distant. From the former hole, a 9.7-foot section of drill core returned an assay result of 0.24 ounce gold per ton, and another 6.1-foot section returned a value of 0.37 ounce gold per ton (The Northern Miner, June 26, 1989). This 196.90 m hole was logged as being entirely in the Stevens Island diorite. Later in the year, Exploration Brex Inc. conducted geophysical and geological surveys on its newly acquired Clytie Bay property, farther to the northeast along the Duport deformation zone, and at the edge of the Canoe Lake stock. Surface grab samples from a mineralized zone were reported (Ontario–Quebec Mining Life and Exploration News, November, 1989) to contain 0.39 ounce gold per ton, 4.05 ounces silver per ton, and 2.4 percent copper, by assay.

Noranda Exploration Company, Limited, following geological, geochemical, and electromagnetic and magnetic surveys in 1988, on a claim group straddling the northwest margin of the Canoe Lake stock from Echo Bay to Clytie Bay, did further geological, geochemical and geophysical surveys, and trenching in 1989. In 1988, a number of elevated gold values up to 9.6 g/t had been obtained from a heavily pyritized zone outcropping on a small peninsula at the west end of Echo Bay.

Voyager Explorations Ltd. continued work that had commenced in 1987 on its Echo Bay claim group, which includes the Echo Bay adit, Rush Bay adit, and Nonesuch, Gauthier and Homestead occurrences. In January of 1989, magnetic and electromagnetic surveys were conducted to complete coverage of the claim group. Nine diamond-drill holes totalling 4000 feet in length were put down between January and March, 1989, to test geophysical and geological targets. Gold assay values were uniformly low, with anomalous values up to 785 parts per billion (ppb) gold over 5 feet in one hole only.

Consolidated Jalna Resources Ltd. continued exploration that had commenced in the fall of 1988 on its Purdex gold property option at High Lake, Ewart Township. Previous drilling in 1958 by Purdex Minerals Ltd. led G. Leary, president of Consolidated Jalna Resources Ltd., to recalculate drill-indicated reserves of 91000 tons grading 0.26 ounce gold per ton. The 1988 drilling in 12 holes was reported to confirm this potential, with visible gold found in some holes (George Cross News Letter, December 30, 1988). A further six holes were diamond drilled in early 1989, for a total length of 8492 feet in all 18 holes of the current program. Current drill-indicated reserves have been calculated by G. Leary to be 250000 tons grading 0.25 ounce gold per ton. Geological mapping and soil sampling were done over the entire seven-claim property during the 1989 field season (G. Leary, Consolidated Jalna Resources Ltd., personal communication, 1989).

Noranda Exploration Company, Limited, as operator, and joint-venture partner Noront Resources Ltd., initiated exploration on a new gold prospect on Chisholm Island, Lake of the Woods, in 1989, following the report of anomalous gold values by J. Ayer, obtained during geological mapping for the Ontario Geological Survey in 1987 (Ayer and Buck 1989). Diamond drilling in one hole intersected 0.42 ounce gold per ton, 1.42 ounces silver per ton and 0.65 percent copper across 7.9 feet, in a sulphide-rich sericite schist unit (The Northern Miner, May 22, 1989). Later in the year it was reported (The Northern Miner, September 18, 1989) that prospecting in the summer had led to a sample returning an assay result of 0.11 ounce gold per ton at a site 1.5 miles from the previous location. Noranda conducted geophysical, geochemical and geological surveys, in addition to diamond drilling and prospecting (W. Reid, Noranda Exploration Company, Limited, personal communication, 1989).

Other work in the Lake of the Woods area included: electromagnetic and magnetic surveys by J. Martin, over claims mostly over the water of High Lake; an airborne VLF-EM and magnetic survey for MCS Capital Ltd. over Cochrane and adjacent islands in the Monument Bay area, Lake of the Woods; geological, soil geochemical and geophysical surveys by Mingold Resources Inc. at Abernathy Lake, southwest of the town of Keewatin (B. Nelson, Mingold Resources Inc., personal communication, 1989); stripping and trenching by G. Pogson at the Stella prospect, Code Township, and near the Black Sturgeon, El Diver and Princess occurrences, Haycock Township; diamond drilling by President Mines Ltd. at the Pine Portage prospect, Kirkup Township; geophysical surveys at Labyrinth Bay, Lake of the Woods, by Homestake Mineral Development Company; geological mapping by R. Kuehnbaum and G. Zebruck at the Passage prospect, Long Point Island, Lake of the Woods; sampling and assaying by E. Roberecki at the old Sultana mine prospect, Lake of the Woods; and geological mapping for R. Theriault at the Ambrose prospect, Gull Island, Lake of the Woods.

Kakagi–Rowan–Pipestone Lakes Area

Unlike previous years, Nuinsco Resources Ltd. conducted no further work on ground outside of its underground operation at Cameron Lake, and no further work was done on properties immediately adjacent to Cameron Lake owned by other companies. The level of exploration was down generally in this area, compared to 1988 when 18 properties were under evaluation, compared with 9 in 1989.

BHP–Utah Mines Ltd. did geological mapping, lithogeochemical and soil geochemical surveys over a 25-claim property at Stephen Lake that includes the north end of the Stephen Lake stock and the Kenty occurrence (R. Thomas, BHP–Utah Mines Ltd., personal communication, 1989).

Dunfrazier Gold Explorations Inc. worked on its Bag Lake property, east of Highway 71, in Tweedsmuir Township. Trenching and stripping was done on two adjacent zones. On the "East" zone, the mineralization was exposed over a 170-foot strike length, with values up to 0.984 ounce gold per ton; on the "West" zone, a 30-foot section averaging 0.649 ounce gold per ton over 3 feet was exposed (The Northern Miner, September 18, 1989).

Rio Algom Explorations Inc. conducted a geological survey covering gold occurrences at the east end of Crow Lake. Rio Algom has an option agreement on part of this ground from Laramide Resources Ltd. and Calnor Resources Ltd. (George Cross News Letter, October 31, 1989).

Placer Dome Inc. conducted geological mapping and geochemical sampling on a 90 km grid, covering ground optioned from R. Fairservice, north of Hope Lake, in the Lobstick Bay area (P. Burchell, Placer Dome Inc., personal communication, 1989).

Noranda Exploration Company, Limited, did a geochemical survey and prospecting on a claim group along the north shore of Lobstick Bay that includes the Lobstick Bay–Thrasher occurrence, which is known for its fluorite content (W. Reid, Noranda Exploration Company, Limited, personal communication, 1989).

Minnova Inc. continued work on its Straw Lake property, at the south end of the Lawrence Lake batholith, in the Bluffpoint Lake area. Fourteen diamond-drill holes were put down in the winter of 1988–1989 for a total length of 8965 feet. Most of these holes continued to test the northeast-trending Moose Creek fault and subsidiary structures (Assessment Files, Kenora Resident Geologist's office).

Ross Island Resources Inc. continued work on their Dash Lake property by carrying out an induced polarization (IP) survey, followed by diamond drilling in seven holes for a total length of 4105 feet, to test anomalies found during the IP survey (Assessment Files, Kenora Resident Geologist's office).

Freewest Resources Inc., in a joint venture with Sparton Resources Inc., conducted ground VLF-EM, magnetometer and IP surveys over an 11-claim group, also in the Dash Lake area and immediately north of the ground investigated by Ross Island Resources Inc. (Assessment Files, Kenora Resident Geologist's office).

Other work done included a VLF-EM survey by Jack Martin and Jason Martin on a seven-claim group at Kakagi Lake, adjacent to the work being conducted by Rio Algom Exploration Inc. (Assessment Files, Kenora Resident Geologist's office), and sampling and assaying by D.J. Sande at Bluffpoint Lake.

Umfreville-Treelined Lakes Area

Champion Bear Resources Ltd. continued exploring the Separation Lake greenstone belt, following airborne geophysical surveys and follow-up diamond drilling over a block of 364 claims centred on Helder Lake, in the Lennan Lake, Treelined Lake and Campfire Lake areas, in 1988. In 1989, a second airborne geophysical survey was conducted over a second large block of claims at the east end of Umfreville Lake. The total number of claims held by Champion Bear in partnership with other companies is on the order of 850. To date, the two main targets have been at Helder Lake, and the Oneman Lake base metal-gold occurrence at Umfreville Lake (L. Chastko, Independent Exploration Services Ltd., personal communication, 1989).

Manitou-Wabigoon-Eagle Lakes Area

International Platinum Corp. continued exploration at its Flambeau Lake prospect, 10 km southwest of Dryden. Following a 35-hole diamond-drill program earlier in 1988, the company diamond drilled a further 10 holes totalling 5470.4 m in length during the winter of 1988-1989. International Platinum Corp. geologists interpret the prospect to be an *en échelon* gold-bearing quartz vein system in a zoned dioritic intrusion (Assessment Files, Kenora Resident Geologist's office).

Raleigh Resources Ltd. diamond-drilled 11 holes totalling 1581.3 m in length on their Fornieri prospect at Buchan Bay, Eagle Lake, following a period of inactivity since 1985. Hole 10 intersected 0.37 ounce gold per ton over 5 feet (The Northern Miner, May 8, 1989).

Noranda Exploration Company, Limited, continued exploration on its claims, which encompass the W.W. Smith prospect at Buchan Bay, Eagle Lake. Geological, geochemical and geophysical surveys were carried out. Noranda diamond-drilled five holes totalling 572 m in length (W. Reid, Noranda Exploration Company, Limited, personal communication, 1989).

Homestake Mineral Development Company performed geological, soil geochemical, VLF-EM, magnetometer and IP surveys over its claim group covering the Peep Bay, Sorry Mac, and Gates Lake occurrences along the Manitou Stretch, southwest of Lower Manitou Lake. Homestake cleaned out and sampled the old trenches. In 1988, Homestake obtained assay results as high as 21950 ppb (21.95 g/t) gold in trench No. 2 at the Gates Lake occurrence (Assessment Files, Kenora Resident Geologist's office).

Wellington Cove Explorations Ltd. conducted geological, VLF-EM, magnetic and IP surveys, and stripping and trenching on its claim group covering the Smooth Rock Bay occurrence at Vickers Lake, 15 km south of Lower Manitou Lake. A composite sample from the main quartz vein over a 7 m strike length averaged 0.386 ounce gold per ton and two samples across a 1.2 m width of the quartz vein averaged 0.697 ounce gold per ton (S. Winter, Wellington Cove Explorations Ltd., personal communication, 1989).

Bond Gold Canada Inc. continued a geological survey on their claims at Whitewater Lake, immediately southwest of Dinorwic Lake, which included their option on the Minnehaha occurrence. In 1988, the company had identified several gold-bearing shear zones. Two significant gold-bearing quartz veins were delineated: the Johnson occurrence and the Johnny Wayne quartz vein. The best gold value obtained from the Johnson occurrence was 0.136 ounce gold per ton over a 1.90 m width, and from the Johnny Wayne quartz vein was 0.42 ounce gold per ton over a 1.95 m width (Assessment Files, Kenora Resident Geologist's office).

Canhorn Mining Corporation optioned the Gold Standard G-340 occurrence, the Sairey Gamp occurrence and the Gold Standard HW-271 occurrence, all near Grant Lake southwest of Lower Manitou Lake, from R. Fairservice. The company conducted an airborne magnetic and electromagnetic survey (Assessment Files, Kenora Resident Geologist's office) and did geological mapping and prospecting.

Black Cliff Mines Ltd. conducted a magnetic survey following geological mapping at the Barker Brothers mine and Petrie occurrences, northwest of Barker Bay, Lower Manitou Lake, in 1988. A grab sample of quartz vein material taken from the muck pile at the Barker Brothers mine returned an assay value of 24540 ppb (24.54 g/t) gold (Assessment Files, Kenora Resident Geologist's office).

B. Barton relocated the old S-500 occurrence at Higbee Lake, 25 km south of Vermilion Bay and southwest of Eagle Lake, and did stripping and sampling. The best gold assay value from this work was 1.88 ounces gold per ton across 16 cm from vein No. 3 (Assessment Files, Kenora Resident Geologist's office). Prospecting by B. Barton around the S-500 occurrence led to the discovery of new occurrences near Higbee Lake, the Barton occurrences, and other gold-bearing shear zones. The best gold value returned from grab samples from the Barton occurrences was 0.84 ounce gold per ton (Assessment Files, Kenora Resident Geologist's office).

A grab sample from a gold-bearing zone 200 m south of the S-500 occurrence returned an assay value of 0.20 ounce gold per ton (Assessment Files, Kenora Resident Geologist's office).

D. Nelson completed a soil survey begun in 1988 over his claim group covering the Dryden Red Lake Syndicate occurrence near Early Lake, between Merrill and Lower Manitou lakes (Assessment Files, Kenora Resident Geologist's office), and conducted geological mapping.

A. Glatz conducted a VLF-EM and magnetic survey on his Aubrey Lake property, 10 km southwest of Dryden, after obtaining an assay result of 0.46 ounce gold per ton from a sample representative of the altered and fractured volcanic rocks on the property (Assessment Files, Kenora Resident Geologist's office).

Equity Silver Mines Limited optioned the Tustin iron formation occurrence (magnetite-pyrrhotite-pyrite), located just south of Highway 17 in Tustin Township, from D. Thibault. Equity Silver did some stripping and trenching, and a soil geochemical survey (G. Irving, Equity Silver Mines Limited, personal communication, 1989).

Other exploration for gold known to have been done in the general Manitou–Wabigoon–Eagle lakes area in 1989, included: stripping west of the Kawashegamuk Lake area, by A. Glatz; VLF-EM and magnetic surveys in Van Horne Township, by A. Glatz and L. Burden; VLF-EM and magnetic surveys over the Pathfinder occurrence in Melgund Township, by A. Glatz; VLF-EM and magnetic surveys in the Boyer Lake area, by J. Redden; a reconnaissance geochemical survey in Laval Township, by Camreco Inc; and, sampling and assaying by R. Fairservice on his Beartrack Lake property in Laval Township, following the termination of an option agreement with Consolidated Jalna Resources Ltd. His best sample came from a sulphidized and silicified diorite which returned a value of 80392 ppb (80.392 g/t) gold (Assessment Files, Kenora Resident Geologist's office).

Fort Frances–Mine Centre Area

Asarco Exploration Co. of Canada Ltd. and Mingold Resources Inc. carried out gold and base metal programs in the Rainy River area, west of Fort Frances. Asarco completed 69 reverse circulation drill holes and five diamond-drill holes in Nelles, Pattullo, Sutherland and Sifton townships as a follow-up to ground and airborne geophysical surveys (R. Dean, Asarco Exploration Co. of Canada Ltd., personal communication, 1989). Mingold Resources Inc. carried out a 25-hole reverse circulation drilling program in Tait, Pattullo and Richardson townships (B. Nelson, Mingold Resources Inc., personal communication, 1989). Both of these programs complement an overburden drilling program conducted by the Ontario Geological Survey in the area (Bajc 1988).

Western Troy Capital Inc.'s exploration program over their 30-claim block in Menary Township included geological, VLF-EM, magnetometer and IP surveys, as well as stripping and sampling on the main showing. Grab samples returning values of up to 1.65 ounces gold per ton, and chip sample values of up to 0.666 ounce gold per ton over 2 m have been reported (G. Clark, Ovalbay Geological Services Inc., personal communication, 1989).

As has been the case for the past number of years, numerous programs were conducted in the general vicinity of Mine Centre. Gold Fields Canadian Mining Ltd. carried out an airborne electromagnetic and magnetometer survey over their claim block in the Little Turtle Lake and Bad Vermilion Lake areas, and also did stripping, sampling and geological mapping. The block includes a new gold occurrence discovered by L. Cousineau and R. Cousineau (P.J. Lougheed, Gold Fields Canadian Mining Ltd., personal communication, 1989).

J.A. Bolen and A. McCormick jointly carried out geological, electromagnetic and magnetometer surveys on their Dino occurrence and Seine River block of claims located in the southeast corner of Shoal Lake, Bad Vermilion Lake area (Assessment Files, Kenora Resident Geologist's office). These surveys were followed by a four-hole, 737-foot diamond-drill program on the Dino occurrence claims, on the north side of the Seine River. On the south side of the river, an additional two holes were drilled, for a total length of 413.6 feet, to test conductors found during a horizontal-loop electromagnetic survey (HLEM) (J. Bolen, Prospector, personal communication, 1989).

G. Armstrong diamond-drilled three holes, totalling 1116 feet in length, in the vicinity of the Pidgeon zinc-copper occurrence 4 km east of Mine Centre. A 7.4-foot section of drill core in one hole returned assay results of 0.02 ounce gold per ton, 11800 parts per million (ppm) Zn, 1340 ppm Pb and 660 ppm Cu (Assessment Files, Kenora Resident Geologist's office).

PIRP Holdings Inc. drilled three holes, for a total length of 666 feet, at the west end of their Golden Star prospect, at the northeast end of Bad Vermilion Lake. The target was an anomaly found during an HLEM survey which was observed to be coincident with a fault (Assessment Files, Kenora Resident Geologist's office).

Nipigon Gold Resources Ltd. carried out an extensive stripping and trenching program on their optioned McKenzie-Gray gold-zinc property at the south end of Bad Vermilion Lake (Assessment Files, Kenora Resident Geologist's office). Trow Consulting Engineers of Thunder Bay carried out a site investigation and design of a tailings disposal area for this property.

Other work included the following: R.W. Pitkanen carried out stripping and trenching on his Turtle Siding occurrence, south of Little Turtle Lake; Coldspring Resources Ltd. conducted stripping on one claim immediately south of Highway 11 (Assessment Files, Kenora Resident Geologist's office); and R. Cone diamond drilled one hole on his Shoal Lake prospect.

BASE METALS

Minnova Inc. carried out 3500 m of diamond drilling in nine holes, borehole pulse electromagnetic surveying, geological mapping and lithogeochemistry on their Swell Bay project (M. Flanagan, Minnova Inc., personal communication, 1989). The project is located in Farrington Township and in the Bliss Lake and Little Turtle Lake areas. Minnova Inc. signed a joint venture agreement with HSK Minerals Limited on an 86-claim block south of Little Turtle Lake, earning Minnova a 51 percent interest in the claims after spending $486000 on exploration over the past three years (The Northern Miner, March 27, 1989). In 1988, core from a 5.7 m length in one drill hole returned assay results of 0.76 percent copper, 2.1 percent zinc and 8 g/ton silver (The Northern Miner, March 27, 1989).

Falconbridge Limited diamond drilled two holes, for a total length of 794 feet, on ground held in Watten Township. One hole tested the eastern extension of their Reef Point prospect, the other a siliceous sulphide horizon on the northwest shore of Rice Bay (Assessment Files, Kenora Resident Geologist's office).

At the Apex copper-nickel property, located in the Atikwa Lake area, Falconbridge Limited carried out a total field and vertical gradient ground magnetic survey, a ground VLF-EM survey and an HLEM survey (Assessment Files, Kenora Resident Geologist's office), in addition to soil geochemical and geological surveys (R. Band, Falconbridge Limited, personal communication, 1989).

International Platinum Corp. conducted geological mapping, HLEM and transient electromagnetic (TEM) surveys, followed by two drilling programs at its Eagle Lake base metal property (L. Burden, International Platinum Corp., personal communication, 1989). Two sulphide horizons were found at contacts between felsic and mafic metavolcanic rocks. Early in 1989, the company diamond drilled nine holes totalling 916.7 m in length (Assessment Files, Kenora Resident Geologist's office), which was followed in the fall of 1989 with a further four holes for a total length of 606 m.

INDUSTRIAL MINERALS

Dimension Stone

C. Nelson conducted stripping, sampling and limited geological work on a number of granite properties in the Kenora district, including areas located to the northeast of Kenora at Forgotten Lake, southeast of Red Deer Lake, and at Kilgour Lake, and southeast of Dryden in the Revell batholith, in Revell Township (Assessment Files, Kenora Resident Geologist's office).

T. Coppola of Canital Granite Ltd. conducted stripping and trenching on a granite property at Red Deer Lake, northeast of Kenora. G. Zebruck sampled a prospective granite occurrence at Snook Lake, north of Kenora (Assessment Files, Kenora Resident Geologist's office).

ONTARIO GOVERNMENT INCENTIVE PROGRAMS

During the year, a total of $259383 was paid out to five designated Ontario Mineral Exploration Program (OMEP) projects. OMEP funding was replaced in 1989 by the Ontario Mineral Incentives Program (OMIP) and a new program, the Ontario Prospectors Assistance Program (OPAP), aimed at assisting individual prospectors. The program appears to have been well received in the Kenora Resident Geologist's District, with 18 projects, for a total of $158690, approved by November 30, 1989.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Current permanent staff of the Resident Geologist's office include: C.E. Blackburn, Resident Geologist; M.R. Hailstone, Staff Geologist; C.C. Storey, Drill Core Library Geologist; C.B. Ravnaas, Assistant Drill Core Library Geologist; and M. Guderyan, Secretary. Contract staff during 1989 included the following people: P.-C. Delisle, Project Geologist in the Dryden–Ignace area, who assumed the position following the transferral of J. Parker to the Red Lake Resident Geologist's office at the end of March 1989, both were assisted by M.E. Perrault; A.K. Schottroff and M.E. Perrault, who prepared Geological Data Inventory Folios; J. Lemay, Clerk-Typist; and A. Anderson, Systems Officer.

In 1989, the exploration properties and mineral occurrences and prospects listed in Table 2.3 were examined by staff of the Kenora Resident Geologist's office. Companies undertaking exploration are indicated in brackets. Their locations are indicated on Figure 2.1.

P.-C. Delisle continued the program of assessment of gold potential and controls on gold emplacement in the Manitou–Stormy lakes greenstone belt that was initiated by J. Parker the previous year. Emphasis was placed on understanding the structural geometry of deposits in the vicinity of Lower Manitou Lake, and also Kawashegamuk Lake. This project is funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA).

Office staff contributed to two geoscience symposia, one organized by Northwestern Region, Mines and Minerals Division, which was held in Thunder Bay in February, and the second which was held in Toronto in December.

At the former seminar, C.E. Blackburn gave a talk on exploration activity in the Kenora Resident Geologist's District, and J. Parker presented a paper resulting from field work the previous summer, entitled "Gold Mineralization in the Manitou–Stormy Lakes Greenstone Belt, Northwestern Ontario: Nature and Timing", authored by J.R. Parker, C.E. Blackburn and M. Perrault.

J.R. Parker presented a paper in May at the annual meeting of the Geological Association of Canada (GAC) in Montreal, entitled "Constraints on Timing and Placement of Gold Mineralization in the Wabigoon

Subprovince near Dryden, Ontario: Evidence for Synvolcanic through Late Tectonic Emplacement", authored by J.R. Parker and C.E. Blackburn, and D.W. Davis of the Geochronology Laboratory, Royal Ontario Museum, Toronto.

During 1989, nine Geological Data Inventory Folios were published, bringing the total published to 33 since commencement of the project in 1985. Another 13 were in various stages of preparation at year end. The project is currently funded by COMDA.

The Kenora Drill Core Library, serving the combined Kenora, Red Lake and Patricia mining divisions, housed 47370 m of completely catalogued core by November 23, 1989; 23462 m of core was collected in the period November 21, 1988, to November 23, 1989.

M.R. Hailstone, assisted by Resident Geologist's office staff, presented an 18-hour prospecting course in Kenora in March, which ran three evenings a week over a two-week period. Thirty-eight people attended.

A very successful field trip, to show results of field work by the Dryden–Ignace Project Geologist, was conducted by J.R. Parker and C.E. Blackburn over a three-day period in June. Exploration industry and Ontario Government geologists were shown evidence for synvolcanic through late tectonic emplacement of gold at a number of deposits in the general Dryden area.

In addition to field trips for industry and government geologists, trips were provided for the Superannuated Teachers Association of Kenora, and for the Dryden High School Conservation Course. Talks were given to students at Lakewood Intermediate School, and for the Kiwanis Club of Lake of the Woods.

Office staff attended the annual meetings of the Prospectors and Developers Association of Canada in Toronto, the Institute on Lake Superior Geology in Duluth, Minnesota, and the Geological Association of Canada in Montreal, Quebec.

A computer-generated and maintained index to the Assessment Files in the Kenora Resident Geologist's office, which has been under development for a number of years, was finally completed, and was advertised as being available in hard copy on an on-demand basis to clients. The file is updated as new files come in, and printouts are available in a variety of formats, the most complete being a listing of every file (as of December 1, 1989, in excess of 2800 files), by NTS map area, file number, company name, area or township name, year(s) work done, number of claims involved, type of work, commodities sought and commodities found. Specific searches can also be made, and the results made available in hard copy.

C.E. Blackburn contributed to *The Geology of Ontario* project of the Ontario Geological Survey by providing input to the preparation of the updated Geological Map of Ontario, and to the innovative Tectonic Map of Ontario. A chapter on the geology of the Wabigoon Subprovince is being written by a team of Mines and Minerals geologists with C.E. Blackburn as team leader.

ACKNOWLEDGMENTS

Various members of the geological staff contributed to the preparation of the following sections:

M.R. Hailstone did the field work on and wrote up the examinations of the following properties: Hay Island prospect; Stella prospect; Gold Hill, Black Jack and Golden Gate prospects; Passage property; Chisholm Island prospect; Ambrose prospect; Black Lake occurrence; and Dome Exploration Jadakin Lake occurrence.

P.-C. Delisle did the field work on and wrote up the examinations of the following properties: Aronson Lake occurrence; S-500 occurrence; Dryden–Red Lake occurrence; and Glatz occurrence. He also did the field work, assisted by M.E. Perrault, for and wrote up the section on Gold Studies in the Manitou–Stormy Lakes Belt.

M.E. Perrault wrote the section on Geological Data Inventory Folios, and C.C. Storey wrote the section on Drill Core Storage Library Program.

C.E. Blackburn wrote the section on Recommendations for Exploration.

PROPERTY EXAMINATIONS

GOLD

Hay Island Prospect

The Hay Island prospect (also known as the Keewatin mine) is located on mining location K7, 800 m south of Needle Point on Hay Island, 13 km southeast of Kenora, on Lake of the Woods.

A large muck pile on the shoreline is easily observed from the lake. Three shafts have been sunk on a quartz vein, one of which is reportedly underwater (Davies and Smith 1988). The shear hosting the quartz vein strikes at 040° and dips 60° to the southeast. The first shaft has a reported depth of 103 feet with 215 feet of lateral development on the 100-foot level, and is located 20 m inland (Bow 1900). The second shaft, on top of a high hill and 100 m southwest of the first, has a reported depth of 65 feet. The third shaft was reportedly sunk to a depth of 30 feet (Coleman 1898). Other pits and trenches are scattered on the property.

The discovery of this occurrence dates back to 1879, when a sample of quartz containing visible gold returned assay results of 37.3 ounces gold per ton and 1.4 ounces silver per ton. It was the first reported gold discovery on Lake of the Woods (Davies and Smith 1988).

The prospect was mined between 1883 and 1884, when an unknown amount of ore was sent to the Argyle Mine, Clearwater Bay, Lake of the Woods, to be milled; no recovery was reported (Davies and Smith 1988). Coste (1885) reported that fine gold could be panned from specimens of quartz vein material collected from the tailings heap. Further underground development was done between 1897 and 1899. No further work has been reported on the prospect, which is still held under the original patent.

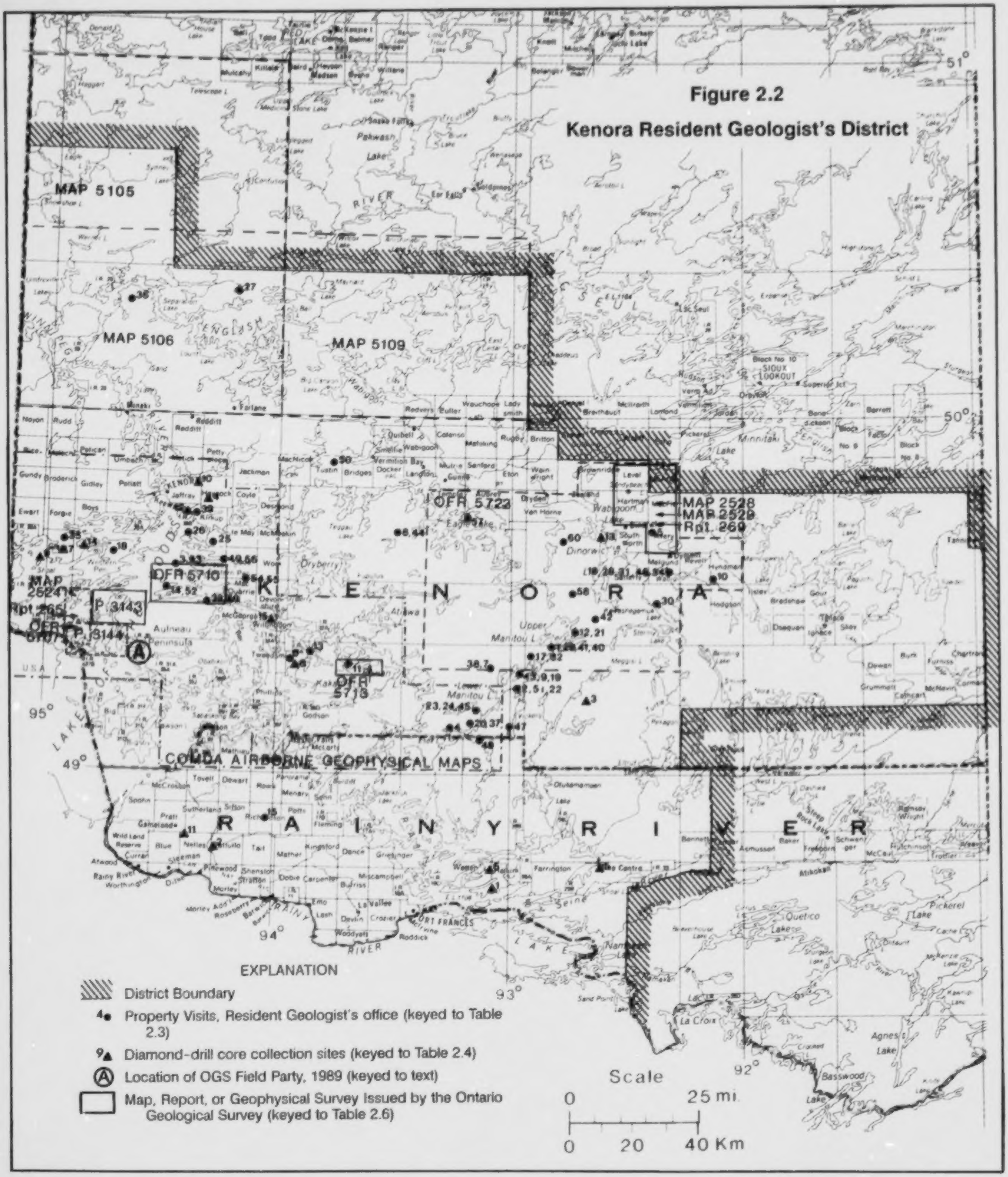


Figure 2.2

Kenora Resident Geologist's District

51°
50°
49°
95°
94°
93°
92°
MAP 5105
MAP 5106
MAP 5109
OFR 5722
MAP 2528
MAP 2529
Rpt. 260
OFR 5710
MAP 2524
Rpt. 265
P. 3143
P. 3144
OFR 5718
COMDA AIRBORNE GEOPHYSICAL MAPS
K E N O R A
R A I N Y R I V E R
Lac Seul
SIOUX LOOKOUT
ENGLISH
Upper Manitou L.
Lower Manitou L.
Aulneau Peninsula
USA
LAKE OF THE WOODS
Quetico Lake
FORT FRANCES
RAINY RIVER
Basswood Lake
Agnes Lake
Pickerel Lake
Lac La Croix
EXPLANATION
District Boundary
4● Property Visits, Resident Geologist's office (keyed to Table 2.3)
9▲ Diamond-drill core collection sites (keyed to Table 2.4)
Ⓐ Location of OGS Field Party, 1989 (keyed to text)
Map, Report, or Geophysical Survey Issued by the Ontario Geological Survey (keyed to Table 2.6)
Scale
0
25 mi
0
20
40 Km

TABLE 2.3. PROPERTY VISITS.

Gold

1. A-212 occurrence, Lower Manitou Lake area
2. Aronson Lake occurrence, Mang Lake area
3. Arsenic Island occurrence, Whitefish Bay area
4. Austin occurrence (Noranda Exploration Company, Limited), Napanee Lake area
5. Avery occurrence, Avery Township
6. Bag Lake occurrence (Dunfrazier Gold Explorations Inc.), Dogpaw Lake area
7. Barker Brothers prospect (Black Cliff Mines Ltd.), Barker Bay area
8. Barton occurrence, Garnet Bay area
9. Beehive prospect (Teck Exploration Co. Ltd., now Teck Corporation), Harper Lake area
10. Black Fox prospect, Hyndman Township
11. Cameron Lake deposit (Nuinsco Resources Ltd.), Rowan Lake area
12. Can American prospect, Boyer Lake area
13. Canadian Arrow prospect (Nuinsco Resources Ltd.), Dogpaw Lake area
14. Chisholm Island occurrence (Noranda Exploration Company, Ltd.), Whitefish Bay area
15. Concession 1, Lot 4, Richardson Township
16. Copeland prospect (Match Resources), Tabor Lake area
17. Dryden-Red Lake occurrence, Lower Manitou Lake area
18. Fox Lake occurrence, Homestake Mineral Development Company
19. Gaffney prospect (Teck Exploration Co. Ltd., now Teck Corporation), Lower Manitou Lake area
20. Gates Lake occurrence (Homestake Mineral Development Company), Napanee Lake area
21. Giant prospect, Boyer Lake area
22. Glass Reef prospect, Lower Manitou Lake area
23. Gold Standard HW-271 occurrence (Canhorn Mining Corporation), Napanee Lake area
24. Gold Standard G-340 occurrence, Napanee Lake area
25. Gold Hill, Black Jack and Golden Gate occurrences, Bigstone Bay area
26. Hay Island prospect, Bigstone Bay area
27. Helder Lake occurrence (Champion Bear Resources Ltd.), Lennan Lake area
28. HW-479 occurrence (International Platinum Corp.), Tabor Lake area
29. King Edward occurrence, Lower Manitou Lake area
30. Lee Lake occurrence, Kawashegamuk Lake area
31. Maw occurrence (Match Resources), Tabor Lake area
32. Merrill Claims occurrence, Lower Manitou Lake area
33. MH-190 occurrence, Longpoint Island area
34. New Klondike occurrence, Melgund Township
35. Noranda-MacIsaac occurrence (Noranda Exploration Company, Limited), Echo Bay area
36. Oneman Lake occurrence (Champion Bear Resources Ltd.), Umfreville Lake area
37. Peep Bay occurrence (Homestake Mineral Development Company), Napanee Lake area
38. Petrie occurrence (Black Cliff Mines Ltd.), Barker Bay area
39. Pine Portage occurrence (President Mines Ltd.), Bigstone Bay area
40. Queen Alexandra Northern occurrence (Bond Gold Canada Inc.), Lower Manitou Lake area
41. Queen Alexandra prospect (Bond Gold Canada Inc.), Lower Manitou Lake area
42. Road Showing occurrence, Boyer Lake area
43. Royal Sovereign prospect, Lower Manitou Lake area
44. S-500 occurrence, Garnet Bay area
45. Sairey Gamp occurrence (Homestake Mineral Development Company), Napanee Lake area
46. Sakoose mine (Match Resources), Tabor Lake area
47. Smooth Rock Lake occurrence (Wellington Cove Explorations Ltd.), Napanee Lake area
48. Sorry Mac occurrence (Homestake Mineral Development Company), Mang Lake area
49. Stella prospect, Code Township
50. Thibault claims, Tustin Township
51. Weasel occurrence, Lower Manitou Lake area
52. Willis claims, Whitefish Bay area

Base Metals

53. Allie Island occurrences, Whitefish Bay area
54. Black Lake occurrence, MacQuarrie Township
55. Bug Lake occurrence, Code Township
56. Dome Exploration (Canada) Ltd.-Jadakin Lake occurrence, Code Township
57. Eagle Lake property (International Platinum Corp.), Garnet and Buchan bays area
58. Glatz occurrence, Turtlepond Lake area
59. Hudbay occurrence, Longpoint Island area

Platinum Group Elements

60. Zinn claims, Butler Lake area

TABLE 2.4. DRILL CORE COLLECTION SITES.

1.	Armstrong, George	condensed core from several properties near Rainy Lake
2.	Asarco Exploration Co. of Canada Ltd.	Pinewood project (1 hole)
3.	BP Canada Inc.	Entwine Lake property (9 holes)
4.	Clark, H.G. (745065 Ontario Ltd.)	Sweden Shaft property (4 holes)
5.	Cleyo Resources Inc.	Golden Star Mine property (2 holes)
6.	Falconbridge Limited	Rice Bay property (2 holes)
7.	Golden Rule Resources Ltd.	Shoal Lake project (2 holes)
8.	Granges Exploration Ltd.	Bag Lake property (4 holes)
9.	Groupe Minier Ariel (162278 Canada Inc.)	Shoal Lake property (3 holes)
10.	Kenora Gold Occurrences Inc.	Rajah, Black Sturgeon, Princess, Roseman properties (22 holes)
11.	Ontario Geological Survey	overburden drilling near Rainy River
12.	President Mines Ltd.	Pine Portage property (9 holes)
13.	Tanqueray Resources Ltd.	Wabigoon project (3 holes)
14.	Voyager Explorations Ltd.	Echo Bay property (9 holes)
15.	Willingdon Resources Ltd.	Sioux Narrows property (4 holes)

There are two veins at the prospect: the west vein, which trends 040° and dips to the southeast at 60°, and the east vein, located approximately 30 m south of the west vein, which trends 010° to 030° and dips to the southeast at 60° to 75°. The west vein is presently covered by muck on the shoreline, but earlier reports state the quartz vein to be 4 feet wide (Bow 1898). At the collar of the shaft on top of the hill, the vein is 15 cm wide at surface. The east vein also pinches and swells and is 5 m wide in places, pinching out altogether along strike. Both veins occupy shears, and in the case of the east vein, the shear is curvilinear with the zones of flexure and dilatancy in the shear occupied by quartz veining. If continuous along the same trends, the two veins intersect some 20 m offshore of the dump.

Most of the significant workings, including the two shafts on shore, are on the west vein, which has the following characteristics. The vein is of "crack and seal" type and contains fragments of wall rock. The vein is crosscut at a low angle by ankerite and tourmaline veins 1 to 2 cm in width. Fragments of vein material in the dump commonly show quartz enveloped by ankerite. Sulphides, as determined from the dump material, consist of pyrite (commonly as cubes averaging 0.25 cm in size), fine-grained arsenopyrite (as veins up to 1 cm wide and as brecciated fragments), and traces of chalcopyrite. Sulphides, as observed in trenches, commonly occur as a halo around vein material in wall rock and within wall rock fragments in the vein. Microveins (0.25 cm wide) of euhedral pyrite were observed cutting foliation in mafic metavolcanic rocks at an angle of 45°. Judging from the old workings, much of the production was derived from the arsenopyrite-bearing west vein.

The east vein is a calcite breccia vein containing angular to subangular fragments of wall rock, some of which have been locally carbonatized along the vein. No evidence of "crack and seal" vein emplacement was found by the author on examination of bedrock exposure in pits and trenches, and of muck samples beside the workings. Sulphides consist chiefly of pyrite, which occurs as disseminations, blebs and stringers within both wall rock and vein, chalcopyrite, as blebs and patches, and minor amounts of arsenopyrite, within the vein.

The sulphides and vein characteristics documented here suggest different styles of mineralizing events for the west and east veins: the west vein occupies a ductile shear environment and is parallel to the strike of the mafic flow host rock, as indicated in the mapping of the Bigstone Bay area (Ayer et al. 1985); the east vein occupies a brittle shear environment and is transcurrent to strike.

There are similarities between the chalcopyrite-rich, calcite breccia east vein and the Cameron copper vein, located on the mainland 6.4 km east-southeast of Hay Island. Both veins have a similar attitude and low gold values. Samples collected by the author on the east vein gave the following results on analysis: 45 ppb Au, 3930 ppm Cu, 101 ppm Zn, 470 ppm As (Geoscience Laboratories Section, Ontario Geological Survey, Toronto). The best assay results from samples collected from the Cameron copper vein are as follows: 0.08 ounce gold per ton, 11.5 ounces silver per ton and 24.5 percent copper (Cameron Copper occurrence, Assessment Files, Kenora Resident Geologist's office). Although the association of gold with chalcopyrite at the nearby past-producing Wendigo mine suggests that chalcopyrite is a favourable indicator for gold, the above occurrences indicate that this is not always the case.

Stella Prospect

The Stella prospect, also known as the Blue Star, Lac La Belle or Contact mine, is located in Code Township, 26 km southeast of Kenora, and can be accessed to within 800 m by truck along a logging road that branches to the right off the Witch Bay road, 6.0 km from its turnoff on Highway 71.

The Stella prospect is hosted by mafic metavolcanic rocks and mafic to ultramafic sills that trend east and face south, and is close to the intrusive contact of a biotite granite to biotite-quartz monzonite phase of the Dryberry batholith to the east. The contact trends northwest under Stella Lake. For the most part, the volcanic rocks and the sills have been metamorphosed to amphibolite facies grade by contact metamorphism.

The Stella prospect was first worked during the period 1897 to 1900, when four shafts, several test pits and an adit were established by the Ontario Mining and Development Co. (Davies and Smith 1988). Between 1935 and 1936, Blue Star Mines Ltd. dewatered shafts and completed further development work on the property (Assessment Files, Kenora Resident Geologist's office). In 1960, E.J. Stone diamond drilled 11 holes for a total length of of 794 m (Assessment Files, Kenora Resident Geologist's office). The property has not been drill-tested since. The original Stella prospect has been staked and is currently held by E. Roberecki, who has done stripping, trenching and shaft dewatering. G. Pogson holds contiguous claims to the east.

The old workings are located close to the southwest shore of Stella Lake, along a 0.5 km long portion of an east-trending, anastomosing shear zone in the mafic metavolcanic rocks. The shear, here called the Stella shear, lies tens of metres north of the contact between the metavolcanic rocks and the peridotitic base of a 200 m thick differentiated sill. There are numerous pits and trenches, a 120-foot long adit, and four shafts ranging in depth from 37 to 147 feet, with a total of 94 feet of lateral development (Sinclair et al. 1938).

The mineralization is hosted by calcite breccia veins within the Stella shear. The quartz veins within the calcite breccia veins are boudinaged and lensoid in shape. Chalcopyrite, pyrite and minor amounts of pyrrhotite are found within quartz vein material and in the calcite matrix of the breccia. Rarely, native copper and bornite rim the chalcopyrite. The presence of chalcopyrite appears to be the best prospecting indicator for gold. Fragments of subangular wall rock material in the calcite breccia veins are chloritic and biotitic.

Examination of several sawn samples by the author showed that there are three generations of vein material. From oldest to youngest these are: 1) opalescent, grey-blue quartz veins that have been brecciated and boudinaged; 2) granular, milky-white quartz veins that were probably associated with the mineralizing event; and 3) calcite brecciation, during which copper was remobilized from chalcopyrite to form native copper and bornite. This sequence agrees with thin section observations made by Davies and Smith (1988), who noted that "The shear zone appears to have been an early deformation zone which was silicified and carbonatized. Later strain resulted in brittle deformation, permitting quartz-carbonate and sulphide vein filling. The strain probably persisted past this period resulting in undulose extinction observed in the late quartz".

To the east of Stella Lake, a shear zone in the granitoid rocks of the Dryberry batholith is along strike with, and has a similar trend to, the Stella shear.

Another east-trending shear zone is located about 600 m to the southeast of the old Stella workings, and 300 m southeast of Stella Lake. This third, more southerly, shear zone parallels the Stella shear, and lies close to the contact of the gabbroic upper portion of the same differentiated sill with the mafic metavolcanic rocks. It exhibits a curvilinear nature similar to that of the Stella shear and a biotite-chlorite alteration, and hosts lenticular quartz veins within calcite breccia.

In 1988 and 1989, G. Pogson blasted seven trenches along the southerly shear zone, and five trenches along the shear zone in the granitoid rocks of the batholith. Sulphides exposed in the trenches are hosted by quartz veins and enveloping calcite breccia, in a similar manner to that at the old Stella workings.

Variations in the dips of the shear zones, combined with their curvilinear nature on horizontal surfaces, suggests that quartz veins emplaced within zones of dilatancy will pinch and swell in both vertical and horizontal planes. For this reason, it would be important to establish gold values in the wall rock.

Sulphide assemblages and the type of alteration within the Stella shear and those trenched by G. Pogson are similar.

Gold Hill Mine, and Blackjack and Golden Gate Prospects

The Gold Hill mine and the Blackjack and Golden Gate prospects are located in Kirkup Township, 20 km southeast of Kenora. Access is provided by a logging road running approximately 3 km east off the Storm Bay road. The properties are covered by 36 contiguous unpatented claims held by G. Zebruck and E. Hansen of Kenora, and 1 patented claim and 13 contiguous unpatented claims held by A. Nilson of Kenora.

The workings consist of eight shafts and numerous pits and trenches within a 0.5 km radius of the Pebble vein at the Gold Hill mine, and are hosted by quartz veins in east-southeast-trending shears. Shafts vary from 59 to 151 feet deep, with a total of 394 feet of lateral development. Most of the workings are on the Gold Hill Mine (Pebble Vein). Detailed descriptions of the above three prospects have been given by Davies and Smith (1988).

The bedrock in the area consists of a south-facing sequence of pillowed and massive mafic metavolcanic rocks and a coarse mafic flow or gabbro intrusion, all having an easterly trend (Ayer et al. 1985). Epidote patches and interpillow pyrite have been presented as evidence of primary interaction between seawater and rock (Stix 1985).

Late northwesterly to northeasterly trending plagioclase-porphyritic intermediate dikes cut the metavolcanic rocks, particularly at the north end of the claim block. The intrusive, northwest-trending contact of a granodiorite phase of the Dryberry batholith, which lies to the east, cuts across the stratigraphy through Hollow and Oblong lakes. The metamorphic grade is greenschist facies, passing to amphibolite facies to the northeast in proximity to the batholith. The workings are located approximately 1 km from the contact with the batholith.

The quartz veins are hosted within east-southeast-trending curvilinear shears emplaced in zones of dilatancy. Field observations lead the author to agree with the interpretation of D. Hodges (Kidd Creek Mines Ltd.) that shear zone fabric indicators suggest a greater vertical than lateral component of strain (Kidd Creek Mines Ltd., Assessment Files, Kenora Resident Geologist's office). Chlorite, biotite and calcite are typical alteration products associated with the shear zones, except in the northwest corner of the property (e.g., Bulldog and Slamdance veins) where ankerite alteration is prevalent. This is probably attributable to decreasing metamorphic grade away from the Dryberry batholith.

The sulphide minerals present, consisting of pyrite, pyrrhotite and chalcopyrite, occur as disseminations, blebs, patches and microveins within the quartz veins and along the cracks of "crack and seal" veins. Chalcopyrite appears to be the best mineral indicator for gold; this is substantiated by assay results from a chalcopyrite-rich sample from the Slamdance vein, reported by Kidd Creek Mines Ltd., of 1.97 percent copper and 66.17 g/t gold (Assessment Files, Kenora Resident Geologist's office). D. Hodges has made several relevant observations regarding data collected during this exploration program. Vein widths vary from 5 cm at the Blackjack vein to 80 cm at the Pebble vein, and in length from discrete veinlets at the Blackjack North vein to 18 m at the Combination vein. Although gold appears to be confined to quartz veins, sheared wall rock with values greater than 100 ppb should be considered anomalous and warrant further prospecting, stripping and trenching.

Since 1983, $300000 has been spent on the property, the bulk of this by Kidd Creek Mines Ltd. (G. Zebruck, Prospector, Kenora, personal communication, 1989). Work consisted of stripping, geological mapping, soil and lithogeochemistry, airborne VLF-EM and magnetometer surveys, and ground magnetometer, VLF-EM and IP surveys (Assessment Files, Kenora Resident Geologist's office). Following the acquisition of Kidd Creek Mines Ltd. by Falconbridge Limited, the property was returned to G. Zebruk and E. Hansen. For that reason, diamond-drill targets outlined by the IP anomalies that were coincident with known and predicted structures were not tested. Gold mineralization in this area has not, therefore, been tested for continuity to depth.

Passage Property

The Passage property is located 40 km southeast of Kenora, in the vicinity of The Passage, at the west end of Long Point Island, Lake of the Woods, a distance of 12 km by boat from Sioux Narrows. R. Kuehnbaum and G. Zebruck hold 14 unpatented claims covering two occurrences: the MH-190 occurrence and the Hudbay occurrence.

At the MH-190 occurrence, a 36-foot deep shaft and five pits and trenches are located on the mainland of the Aulneau Peninsula at the south end of The Passage, immediately north of West Pointer Island (Bow 1898). The old shaft is 35 m from the shoreline. Gold values up to 9455 ppb were reported from samples collected by B. Christie from the trench located right at the shore (E. Roberecki, Assessment Files, Kenora Resident Geologist's office). A more recent channel sample from the same trench, on analysis gave 0.50 ounce gold per ton over 0.7 m (R.M. Kuehnbaum, G. Zebruck, Assessment Files, Kenora Resident Geologist's office). Sulphides and boudinaged lensoidal quartz veins are hosted within easterly trending shears. These shears cut easterly trending pillowed and massive mafic metavolcanic rocks and a coarse-grained gabbroic flow or sill. The area has been most recently mapped by Johns (1987), but the gabbroic unit was not recognized in this mapping. The mafic rocks have been intruded by quartz-feldspar porphyries which preferentially intrude shears and have themselves been sheared, and on the east side of The Passage, a small stock of granite intrudes the mafic metavolcanic rocks. The Aulneau batholith is in intrusive contact with the mafic metavolcanic rocks 1 km south of the occurrence, and has elevated their metamorphic grade to amphibolite facies.

A sheared, quartz-feldspar porphyry at the north end of the trench at the shoreline is in contact with sericitic, carbonatized, sulphidic schist containing knots and boudins of quartz. Sulphides noted in the schist by the author consisted of up to 7 percent pyrite and pyrrhotite, both disseminated and in stringers, and traces of chalcopyrite.

Sawn samples collected by the author from pits farther back from the shore, close to the shaft, show 1 cm bands of graphite with disseminated pyrite, in amounts up to 1 percent.

Kuehnbaum and Zebruck have carried out VLF-EM, magnetic, humic geochemical and geological surveys over the property (R.M. Kuehnbaum, personal communication, 1989). A bifurcating VLF-EM conductor appears to correspond with the showing exposed in trenches, but runs just south of the shaft (R.M. Kuehnbaum, G. Zebruck, Assessment Files, Kenora Resident Geologist's office).

The Hudbay occurrence is located 1.2 km southeast of the southern entrance to The Passage, on an island adjacent to Long Point Island. In 1976, Hudson Bay Exploration and Development Co. Ltd. diamond drilled two holes totalling 383 feet in length. The easternmost hole intersected mafic metavolcanic rocks interbedded with intermediate to felsic pyroclastic rocks and wacke, with the pyroclastic section containing pyrrhotite, pyrite, 1 percent chalcopyrite and 5.0 percent sphalerite (Hudson Bay Exploration and Development Co. Ltd., Assessment Files, Kenora Resident Geologist's office). A 2 m wide, sheared, sericitic sulphide zone exposed on the shore, approximately 50 m east of the previously mentioned diamond-drill hole, was sampled by Kuehnbaum and returned the following results: 1560 ppm copper, 1400 ppm zinc and 230 ppb gold (R.M. Kuehnbaum, personal communication, 1989). Additional assay results from a humus sampling program by R.M. Kuehnbaum were not available at the time of writing.

Both the MH-190 and the Hudbay occurrence are located about 1.5 km south of the Pipestone-Cameron fault, which underlies Long Bay. To the west, Noranda Exploration Company, Limited's, Chisholm Island occurrence and the Ambrose prospect are both within splays off the Pipestone-Cameron fault (Ayer et al. 1988). The MH-190 occurrence and the Hudbay occurrence may also be along a similar splay. All these occurrences may therefore have a common genesis as is also suggested by their spatial relationship to quartz-feldspar porphyries.

Chisholm Island Prospect

Chisholm Island, Lake of the Woods, is located 30 km south of Kenora and is equidistantly accessible by boat from either Sioux Narrows or Kenora. On the north shore of the island, a 5 m wide, carbonatized, pyritic sericite schist trending at 105° was sampled for analysis during the course of mapping by the Ontario Geological Survey and returned an anomalous 110 ppb gold value (Ayer and Buck 1989). Subsequently, Noranda Exploration Company, Limited, as operator in a joint-venture program with Noront Resources Ltd., did further sampling and geological mapping, and conducted ground VLF-EM and magnetometer surveys. Samples collected during this program returned assay results of up to 1.41 g/t gold and 950 ppm arsenic (Noranda Exploration Company, Limited, Assessment Files, Kenora Resident Geologist's office). A VLF-EM conductor was tested with three short diamond-drill holes. One drill hole intersected 7.9 feet grading 0.42 ounce gold per ton, 1.42 ounces silver per ton and 0.65 percent copper in massive sulphides (Vancouver Stockwatch, September 12, 1989).

The island is underlain by a north-facing sequence of mafic to intermediate flows and felsic pyroclastic rocks, with intercalated clastic metasedimentary units.

Locally, quartz-feldspar porphyry dikes intrude these supracrustal rocks, and their emplacement appears to have been within shear zones. Later gabbroic dikes intrude the supracrustal rocks and quartz-feldspar porphyries, and commonly contain angular xenoliths of the earlier rock types and rounded clinopyroxene phenocrysts up to 1 cm in diameter.

The west-northwest-trending Pipestone–Cameron deformation zone lies just north of Chisholm Island. Splays from the zone lie south of the island (Ayer et al. 1988). An aureole of amphibolite metamorphism extends approximately 1 km into the supracrustal rocks from their contact with the Aulneau batholith, which is located 3.5 km south of Chisholm Island.

An analysis of bedding, foliation, mineral lineations and folding by Ayer and Buck (1989) suggests that two periods of deformation took place in the Chisholm Island area. Both events are attributable to north-south compression: the earlier event appears to be dominantly vertical and the later event dominantly right lateral. Kinematic indicators suggest a south-side-up vertical movement. Steep, westerly plunging folds are characteristic of the later event.

A mineralized shear has been stripped and channel sampled by Noranda Exploration Company, Limited, along the north shore of Chisholm Island. The sericitic, sulphide-bearing schist was observed to host euhedral pyrite and traces of chalcopyrite. The VLF-EM conductor tested by diamond drilling strikes into the mineralized zone and probably maps out the shear associated with the gold occurrence (Noranda Exploration Company, Limited, Assessment Files, Kenora Resident Geologist's office). The proximity of this gold occurrence to the Pipestone–Cameron deformation zone, and the pervasiveness of splays related to this structure, suggest that further new gold occurrences could be found in the Chisholm Island area. Prospecting by Noranda Exploration Company, Limited, on their Chisholm Island property has led to the announcement that a grab sample taken "1.5 miles on strike from the discovery hole" returned an assay result of 0.11 ounce gold per ton (Vancouver Stockwatch, September 12, 1989).

Ambrose Prospect

The Ambrose, or Gull Island prospect, is located on Gull Island, Lake of the Woods, 27 km south of Kenora. The prospect is presently staked as part of a group of 104 contiguous unpatented mining claims held by J. Conway and R. Theriault of Kenora.

The old workings are located on the south end of the island and consist of a 12 m deep shaft, a 12 m long adit and numerous pits and trenches. Since 1934, 31 diamond-drill holes totalling 2138.3 m in length have been completed on the property by Lake Hill Gold Mines Ltd., Arjon Gold Mines Ltd., Pango Gold Mines Ltd. and A. Hopkins, and stripping and trenching, and ground VLF-EM, magnetometer and geological surveys have been done by Sylvanite Gold Mines Ltd., C. Kuryliw, and New Ambrose Resources (Assessment Files, Kenora Resident Geologist's office).

The bedrock on Gull Island, most recently mapped by Ayer and Buck (1989), consists of clastic metasedimentary rocks, dominantly wacke and mudstone, intercalated with mafic to intermediate tuff breccias and crystal tuffs, and felsic tuffs. On the south end of the island, four east-trending, quartz-feldspar porphyry dikes intrude the metasedimentary rocks. Three northwest-trending diabase dikes crosscut all other rock types. Of the four quartz-feldspar porphyry dikes on the south side of the island, the northern two dikes host most of the workings and show the greatest degree of alteration.

The Ambrose prospect has been interpreted by Ayer and Buck (1989) to be related to a splay off the Pipestone–Cameron deformation zone that trends easterly across the northern tip of Gull Island. Ayer and Buck recognized an early vertical component of movement, and a later right-lateral component. Small-scale folds measured on Gull Island plunge westerly at 60° to 80°. Shearing on the south side of Gull Island has resulted in the pinching and swelling of quartz-plagioclase porphyry dikes and the brittle quartz-carbonate-filled extension fractures within them. Deformation of the more ductile wacke has resulted in a slaty cleavage and increasing intensity of shearing close to dike contacts, which are themselves sheared. Carbonate alteration and local silicification are present.

Recent work by Kormos (1988) has better defined the geological environment of the Ambrose prospect. Quartz veins occupying tension fractures cut plagioclase-feldspar veins within the two felsite dikes. Quartz veins are both vertical and flat-lying. Alteration of the dikes includes ferroan carbonatization, silicification and pervasive albitization. Alteration has obliterated the primary porphyritic texture in these two dikes. Sulphides occur as disseminations, patches and microveins within quartz veins, and as disseminations in the albitized groundmass of the felsite host. The sulphides consist of euhedral pyrite, and subhedral galena, sphalerite, chalcopyrite and pyrrhotite. Gold occurs as free grains within veins and along vein selvages.

Assay values from samples reported by Lake Hill Gold Mines Ltd. in 1936 include 6.06 ounces gold per ton from a grab sample, and 0.784 ounce gold per ton over 4.23 feet from drill core (Ayer and Buck 1989).

The felsite dikes have been traced for 400 m along strike, and because they pinch and swell in a horizontal and vertical sense, their widths can vary from 0.5 to 5 m. The continuity of the gold-bearing system is indicated by the presence of old workings on a quartz vein in an altered felsite dike, on a peninsula some 500 m east of the shaft.

A program of stripping and bulk sampling would allow the determination of a more refined structural model and a better understanding of the distribution of gold. The sheared, sericitized wacke within the southern shear zone has as far as is known never been tested for gold content. Furthermore, there is no record of the sheared rocks on the north side of Gull Island having been tested for gold content. A detailed humus geochemical survey over the island may help delineate further showings now covered by overburden.

Aronson Lake Occurrence

The Aronson Lake occurrence, 60 km south of Dryden, is on an island and on the peninsula at the northwest end of Aronson Lake, immediately southeast of Lower Manitou Lake.

This occurrence was most recently investigated by Consolidated Jalna Resources Ltd. (formerly Jalna Resources Ltd.), who held claims covering it as part of a larger staked area, from 1984 to 1989. In 1984, Jalna Resources Ltd. carried out geological, VLF-EM, magnetic and IP surveys which covered 18 claims. Two northeast-trending, anomalous IP zones, coincident with VLF-EM and magnetic anomalies, correspond to the upper section of auriferous sulphide chert units (Assessment Files, Kenora Resident Geologist's office).

Jalna Resources Ltd. selected a clastic metasedimentary unit, near the western contact with mafic metavolcanic rocks, as a first priority target. The clastic metasedimentary rocks are characterized by argillite, siltstone, chert breccia and gossan zones. The sulphide minerals consist of 2 to 4 percent disseminated pyrite and pyrrhotite. A second clastic metasedimentary unit, almost identical to the first unit and also near the western contact with the mafic metavolcanic rocks, was selected as a second target. Most of the work to date has been done on the better-exposed second unit, where the results of a rock geochemical survey has delineated a zone of anomalous gold values over a length of 800 m and a width of 15 to 100 m.

The author investigated only the latter zone, on the peninsula and on the small island. The occurrence lies within sheared, gossanous metasedimentary rocks of the Etta Lake group. On the peninsula, the metasedimentary rocks are in contact with plagioclase-phyric metabasalt. Bedding strikes at about 020° and dips 75° to the east. Flame structures and cross-bedding indicate the bedding to face west. Narrow shear zones strike at about 035° and dip 88° to the southeast, and the rotation of the schistosity into the shear fabric indicates a sinistral component of strike-slip movement.

The shear zones are characterized by semimassive sulphides with or without quartz veining. The sulphides consist of 20 to 50 percent pyrite and traces of chalcopyrite. According to Jalna Resources Ltd., pyrrhotite is commonly present. The chemical analyses done by Jalna Resources Ltd. indicate a weak correlation between elements such as copper, zinc, silver, lead and arsenic, and gold; analyses of samples taken during the present study support this correlation. Assays obtained by Jalna Resources Ltd. mostly reported low anomalous gold values in the hundred ppb range, but their best gold value was 3830 ppb, from a sample taken on the island.

On the peninsula, a 16 cm wide, semimassive sulphide zone is exposed in the stripped area over a length of a few metres. A grab sample of the semimassive zone returned values of 360 ppb Au, 2 ppm Ag, 178 ppm Cu, 425 ppm Zn and 58 ppm Pb, on analysis. On the island, a quartz vein occurs along the edge of the west shore over a minimum length of 15 m. The footwall of the vein is a semimassive sulphide zone of unknown width. The 10 cm wide, smokey-grey quartz vein contains up to 10 percent pyrite and 1 percent chalcopyrite. A grab sample of the mineralized quartz vein returned values of 3410 ppb Au, < 2 ppm Ag, 750 ppm Cu, 410 ppm Zn and 46 ppm Pb, on analysis. Another grab sample of the unmineralized quartz vein returned values of 1780 ppb Au, 3 ppm Ag, 8 ppm Cu, 16 ppm Zn and 96 ppm Pb. The hanging wall of the quartz vein returned values of 75 ppb Au, < 2 ppm Ag, 435 ppm Cu, 161 ppm Zn and < 10 ppm Pb. The semimassive zone returned values of 480 ppb Au, < 2 ppm Ag, 356 ppm Cu, 710 ppm Zn and 20 ppm Pb. The highest gold value came from a grab sample of rusty, brecciated and sericitized chert, containing fine disseminated pyrite, which yielded 0.57 ounce Au per ton, 4 ppm Ag, 19 ppm Cu, 35 ppm Zn and 246 ppm Pb (all samples analyzed by Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

The clastic metasedimentary units which host the Aronson Lake occurrence (Figure 2.5, location 2) and the Weasel occurrence (51)[1] 1.5 km to the northeast—where grab samples from two narrow quartz veins returned values of 0.534 ounce gold per ton and 0.255 ounce gold per ton—should be further investigated. The geophysical survey done by Jalna Resources Ltd. at the Aronson Lake occurrence did not cover the waters of Aronson Lake: there is potential for gold in the extensions of the shear zones that host the occurrence, and further geophysical surveys over Aronson Lake are recommended. Trenching, detailed mapping and sampling are suggested before carrying out a drill program.

S-500 Occurrence

The S-500 occurrence is located 25 km south of Vermilion Bay, on the south shore of Higbee Lake, between the first and second narrows from the west end of the lake. An old adit is located 13 m southeast of the lake shoreline (Figure 2.3).

The occurrence was found in the 1890s by N. Higbee, on mining location S-500 (Carter 1904). There is no reference to further work. In 1989, B. Barton, prospector, Vermilion Bay, relocated the old adit and did some stripping and sampling. He exposed three narrow gold-bearing quartz veins, two with a parallel north-northeast strike, and a third cutting them at a high angle.

The occurrence lies within a large intermediate to felsic intrusion, immediately north of the Mulcahy Lake intrusion. Gold-bearing quartz veins are hosted by sheared quartz diorite which contains blue quartz "eyes" and has been pervasively carbonatized (calcite

---

[1] *Numbers in parentheses, here and throughout this report, refer to locations appearing on Figures 2.2 and 2.5 and listed in Table 2.3.*

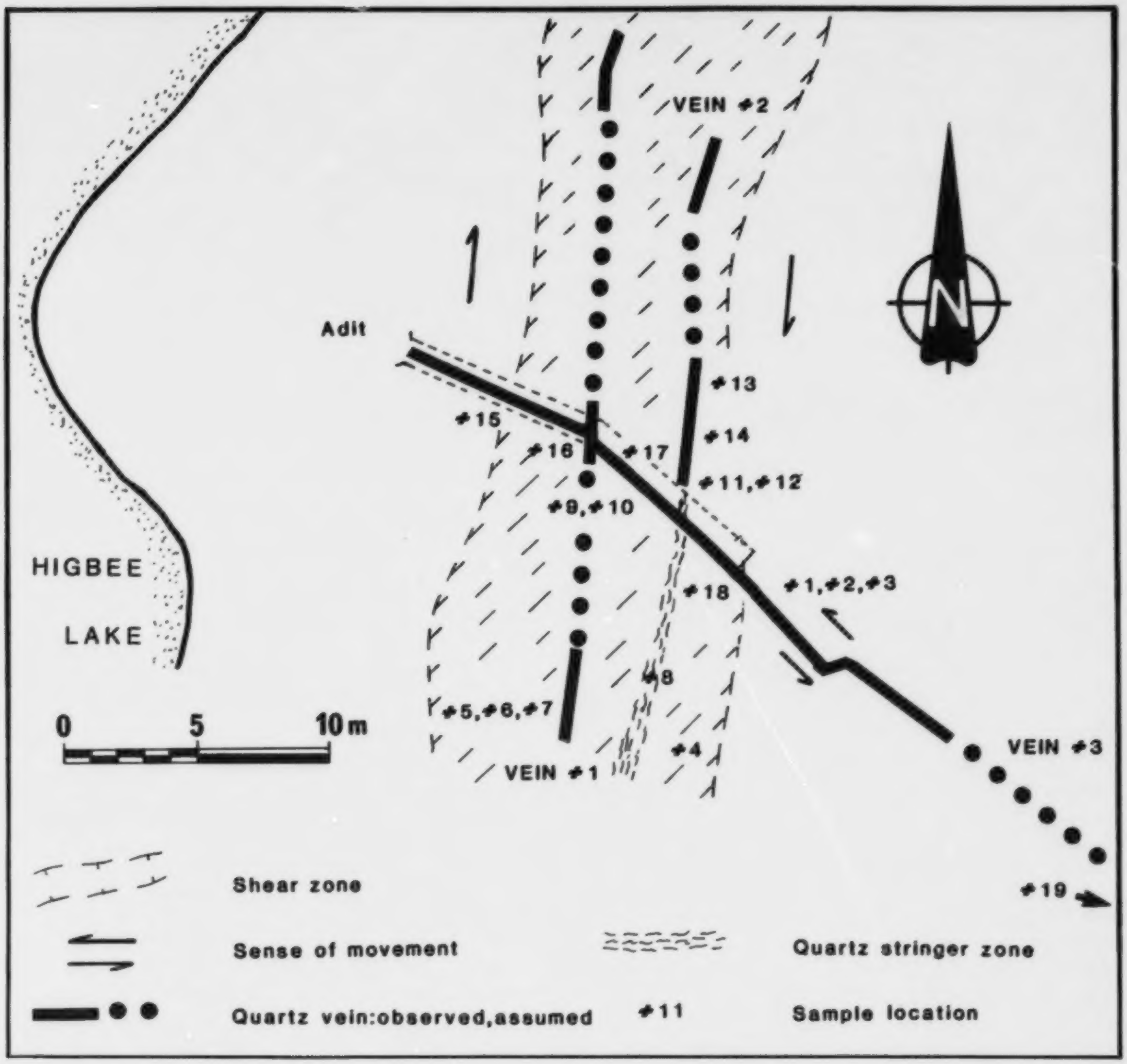

VEIN #2
Adit
#15
#16
#17
#13
#14
#11, #12
#9, #10
HIGBEE
LAKE
#18
#1, #2, #3
#8
#5, #6, #7
0
5
10 m
VEIN #1
#4
VEIN #3
#19
N
Shear zone
Sense of movement
Quartz stringer zone
Quartz vein:observed,assumed
#11
Sample location

Figure 2.3. Geology of the S-500 occurrence.

and ankerite). The 10 m wide shear zone strikes at 015° and dips 86° to the northwest. The strike of internal foliation ranges from 175° to 230°. The shear zone contains two steeply dipping quartz veins 3 m apart, exposed over a strike length of 25 m.

Within the north-trending shear, lineations trend 026/73°, and there is dextral offset of the east-trending quartz vein in the adit along the shear zone. The north-trending quartz veins have a "Z" shape in plan. All these observations indicate a dextral oblique slip movement within the shear zone.

The third quartz vein occurs in a moderate deformation zone 1 m wide. The adit was driven along the vein a distance of 15.3 m. The vein can be traced for a distance of 240 m to the east. Within the east-trending shear zone, the sigmoidal schistosity, the "S" shape of the quartz vein, and slickenside lineation at 120/37°, indicate a sinistral oblique slip.

All of the quartz veins are gold bearing. The best gold values obtained for each vein are: 1) 1.88 ounces gold per ton in vein No. 3; 2) 8130 ppb gold for vein No. 2; and 3) 4640 ppb gold in vein No. 1 (Geoscience Laboratories Section, Ontario Geological Survey, Toronto). The sulphides consist of up to 2 percent disseminated pyrite and < 1 percent chalcopyrite.

The occurrence itself is very limited in that gold is restricted to narrow quartz veins 10 to 16 cm in width. However, the Higbee Lake area holds potential for "grass roots" exploration. The area is characterized by a network of numerous conjugate shears, and although at the S-500 occurrence gold is confined to quartz veins, there is potential for other shear zones to contain gold.

Prospecting by B. Barton in 1989 led to the discovery of other gold-bearing quartz veins. Two kilometres northeast of the S-500 occurrence, the Barton occurrences consist of several shear zones with gold-bearing quartz veins. A grab sample taken by the author from one of these, a 1 to 7 cm wide quartz veinlet that contains traces of pyrite and chalcopyrite, returned 6530 ppb gold on analysis. Another shear zone, 100 m south of this, is exposed over a 25 m length and a width of 4.5 m. The shear zone trends 040° and hosts an 85 cm wide quartz vein. A grab sample of this quartz vein, taken by the author, contained traces of pyrite and returned a gold value of 1140 ppb gold, and a sample of the associated wall rock returned a value of 205 ppb gold (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Dryden–Red Lake Occurrence

The Dryden–Red Lake occurrence is located 51 km south of Dryden, at a point about 2 km north of Blanchard Bay, Lower Manitou Lake, on the west side of the south-flowing creek which connects Early Lake to Blanchard Bay.

This occurrence was discovered in the early 1930s by a group known as the Dryden–Red Lake Prospecting Partnership (Thomson 1934). No further work on this occurrence was reported until 1987, when D. Nelson began work that included geological mapping, and soil and rock geochemistry. The author interprets the soil geochemical analyses to indicate two parallel, undulating gold-bearing zones trending 025°. One of these gold-bearing zones includes a shallow trench and a number of old pits, four of which, on former mining claim K2205, constitute the original showing. This gold-bearing zone has a minimum length of 750 m and a width of about 35 m. The second zone is 50 m east of the first, and appears to be as yet untested. The trend of the auriferous zones is slightly different from that shown by Thomson (1934).

The four exploration pits were sunk on a 5 m wide shear zone that strikes at 020° and dips 40° to the east. The zone is characterized by fissile, calcite-bearing, mica-hornblende-plagioclase schist, probably derived from the host mafic metavolcanic rocks of the Blanchard Bay group (Blackburn 1982).

Deflection of the schistosity into the shear fabric, and the geometry of the extension quartz veins, some of which are rotated into a "Z" shape in relation to the trend of the shear zone, indicate dextral strike-slip or oblique dip-slip movement within the shear zone. In addition, the contouring of values obtained in the soil survey shows a right-stepping attitude to the anomalous gold zones.

The quartz-carbonate veins are pale to dark grey, and locally white. The veins generally have a sugary texture, with chlorite clots, ankerite, and minor amounts of tourmaline and hornblende. The widths of the exposed veins vary from 10 to 40 cm and some are boudinaged. Less than 1 percent fine- to medium-grained pyrite occurs within the quartz veins, whereas the wall rock has up to 2 percent pyrrhotite and pyrite combined.

At pit No. 4, one grab sample of the quartz vein taken by the author yielded 0.658 ounce gold per ton. At pit No. 2, four quartz veins are exposed over a 2 m width. Grab samples from the vein returned 0.145 ounce gold per ton and the wall rock returned 0.048 ounce gold per ton (Temiskaming Testing Laboratories, Mines and Minerals Division, Ministry of Northern Development and Mines, Cobalt).

BASE METALS

Black Lake Copper-Zinc Occurrence

Black Lake is located 37 km southeast of Kenora, in the northeast corner of MacQuarrie Township. The east side of the lake is accessed by two roads from Highway 71, approximately 800 m to the east. The occurrence is located at the southwest end of Black Lake near its outflow into Black River. Following an airborne geophysical survey conducted by Hudson Bay Exploration and Development Co. Ltd. in 1972, the company conducted an electromagnetic survey to further delineate conductive zones within their claim block, which straddles the folded contact between mafic Black River metavolcanic rocks to the north and the Warclub metasedimentary rocks to the south. An east-striking conductive zone was tested with a 34.1 m diamond-drill hole, one of five drilled in the Black Lake area (Assessment Files, Kenora Resident Geologist's office).

The area has been most recently described by Johns (1987). The northeast-trending 2100 m thick Black River metavolcanic rocks are folded about an east-northeast-trending anticline. The clastic metasedimentary rocks of the Warclub group consist of quartz wacke, siliceous siltstone and graphitic argillite beds. The graphitic argillite beds are commonly sulphidic, containing pyrite, pyrrhotite and traces of chalcopyrite and sphalerite. A second deformational event, attributable to the intrusion of the Viola Lake stock, has been interpreted to have refolded first phase east-trending folds, such as the one in the Black River volcanic rocks, about northerly trending axes (Brown 1984). One of these, a synclinal axis, passes close to the base metal occurrences under discussion. The supracrustal rocks are bordered on the east by the Dryberry batholith along a north-trending contact; the batholith is mantled by a contact metamorphic aureole of amphibolite grade up to 1 km wide.

The sulphides in the occurrence are hosted within an interbedded wacke, siltstone and argillite unit averaging 20 to 30 m in thickness. Individual beds within the unit average 10 cm in thickness. Argillite beds alternate

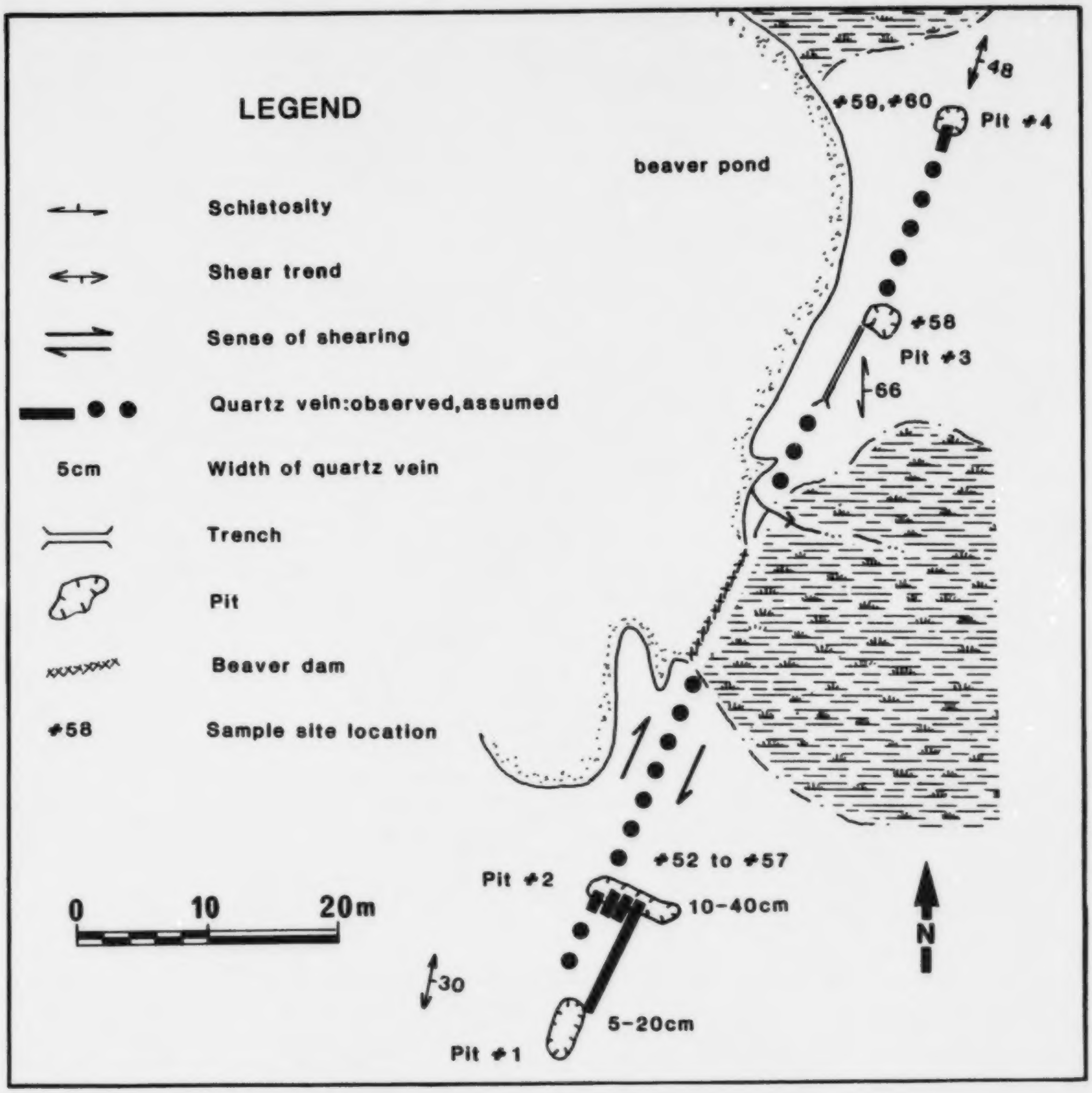

LEGEND
Schistosity
Shear trend
Sense of shearing
Quartz vein:observed,assumed
5cm
Width of quartz vein
Trench
Pit
Beaver dam
#58
Sample site location
0
10
20m
beaver pond
48
#59,#60
Pit #4
#58
Pit #3
66
#52 to #57
Pit #2
10-40cm
30
5-20cm
Pit #1
N

Figure 2.4. Geology of the Dryden–Red Lake occurrence.

with wacke to siltstone beds and in some cases contain ripped up clasts of the siltstone and wacke. Folding on a scale of 1 to 2 m amplitude is a common feature within the unit, with axial planes striking north, parallel to the major second phase synclinal axis.

Sulphides occur for the most part as stringers of pyrite (7 to 10%) within the argillite beds. Chalcopyrite and sphalerite occurring as patches and 1 cm diameter lenses, respectively, were observed, but are rare. Pyrrhotite and pyrite (1 to 2%) occur as blebs and disseminations within the wacke beds.

The possibility should be considered that a small diorite stock close by could have provided the heat to drive hydrothermal fluids that could be the source for zinc and copper mineralization.

The mafic metavolcanic rocks of the Black River group that underlie the metasedimentary rocks in this area are medium grained and massive. No minerals typical of footwall alteration assemblages associated with base metal mineralization were observed by the author in the metavolcanic rocks. However, andalusite, garnet and staurolite, which may indicate metamorphism of such an alteration assemblage, are indicated on Map P.2498 (Johns and Richey 1982) in the wackes to the east of the mouth of the Black River. The suggestion that these represent an alteration assemblage, rather than the products of the amphibolite grade metamorphism of aluminous felsitic sedimentary rocks, is borne out by the fact that these combinations of minerals are not indicated elsewhere on Map P.2498 in any other of the Warclub metasedimentary rocks.

A lake sediment survey conducted by the Geological Survey of Canada indicates local zinc and copper anomalies in several sample sites close to Black Lake (Hornbrooke and Friske 1989).

Dome Exploration Jadakin Lake Occurrence

A base metal occurrence discovered in core diamond drilled by Dome Exploration (Canada) Ltd. is located 27 km southeast of Kenora, at the Manross-Code townships boundary line. The showing is accessed to within 400 m by a logging road which is a side road off the Loon Lake road. The Loon Lake road can be accessed 6 km down the Witch Bay road from Highway 71. In 1972, Dome Exploration (Canada) Ltd. diamond drilled six holes totalling 554.7 m in length to test an anomalous zone detected by airborne and ground geophysical surveys (Assessment Files, Kenora Resident Geologist's office). In 1988, an airborne geophysical survey was flown over a block of 111 claims that included the occurrence for Manontex Ltd., which still holds the claims.

The area has been most recently mapped by Ayer et al. (1985, 1988), Trowell et al. (1987) and Johns (1987). The occurrence lies within a sequence of south-facing clastic metasedimentary rocks consisting of quartz wacke, siliceous siltstone and graphitic argillite intercalated with intermediate to felsic lapilli tuff and quartz-feldspar crystal tuff. The sequence has been intruded by a gabbroic body, subsequently sheared, and is bounded to the north by the Witch Bay fault and to the south by the Viola Lake stock. Late quartz-feldspar porphyry dikes are also present in the area. Two deformational events have been recognized (Brown 1984), which have resulted in early, broad, east-trending folds, and late north-trending isoclinal folds. Alteration consists of microfractures filled by carbonate and ankerite veins. Sericitic alteration is common in the felsic flows.

Observations by the author at the occurrence, and information taken from diamond-drill logs submitted by Dome Exploration (Canada) Ltd., indicate that the sulphides consist of pyrite, pyrrhotite, minor amounts of chalcopyrite and traces of sphalerite, hosted by graphitic argillites, felsic metavolcanic rocks and siliceous metasedimentary rocks. The sulphides occur as disseminations and blebs in felsic tuffs and siliceous metasedimentary rocks, and as stringers within the graphitic metasedimentary rocks. The best intersection reported from the drilling by Dome Exploration (Canada) Ltd. is hosted within graphitic argillite, and returned assay results of trace Au, nil Ag, 0.130 percent Cu and 0.65 percent Zn (Assessment Files, Kenora Resident Geologist's office). At the occurrence, an east-trending linear topographic low coincides with a 1.2 km long anomaly (Assessment Files, Kenora Resident Geologist's office).

The author collected five samples for chemical analysis along the south side of the topographic lineament, and also sampled the sheared gabbroic unit and quartz-tourmaline veins along the north side. The results were not available at time of writing.

Glatz Occurrence

The Glatz occurrence is located 35 km south of Dryden, 1.5 km west of Highway 812, and north of Pincher Lake.

In 1965, A. Glatz found some disseminated sulphides which returned low nickel and copper values. In 1966, Victoria Algoma Mineral Company Ltd. optioned the property from A. Glatz and carried out a VLF-EM survey over the whole property and a magnetic survey over parts of it. The VLF-EM survey outlined seven conductors with no coincident magnetic anomalies. A high-grade nickel-copper occurrence was subsequently found by A. Glatz, who opened up trenches on it.

In 1970, Lynx-Canada Explorations Ltd. optioned the property from A. Glatz, and opened up seven more trenches, and stripped four areas over the most intense magnetic anomalies detected by the previous magnetic survey, over a strike length of 700 m. Nickel-copper sulphides were exposed in all the trenches. The semimassive sulphides returned values of 1.95 percent nickel with 0.45 percent copper, and 0.55 percent nickel with 1.6 percent copper from two grab samples, and samples with disseminated sulphides averaged 0.7 percent combined nickel + copper (A. Glatz, Prospector, personal communication, 1989). Glatz reported that in one trench, Lynx-Canada calculated a 1 percent copper equivalent (copper and nickel dollar values combined) over 46 feet.

A. Glatz allowed the claims to lapse, and in 1987, St. Joe Canada Inc. restaked the occurrence and performed a geological survey and evaluated the property for platinum group minerals. The claims were again allowed to lapse, and in 1989 A. Glatz restaked the occurrence.

The occurrence is in a fine to very coarse grained quartz melagabbro to feldsphathic quartz gabbro, that is a part of the dioritic to gabbroic rim which occurs around the eastern margin of the Doré Lake lobe of the Atikwa batholith (Blackburn 1981). This rim hosts several nickel-copper occurrences.

The author visited five trenches spaced over a total length of 285 m (trench No. 2 to trench No. 6). All of the trenches exposed 1 to 10 percent disseminated sulphides to narrow semimassive sulphide bands. The sulphides consisted of pyrrhotite, pentlandite, chalcopyrite and traces of pyrite. Some of the sulphides have been remobilized along cleavage planes at a high angle to the shear direction. The semimassive sulphide bands vary in width from 2 to 40 cm. The bands have been overprinted by strong shearing which strikes at about 100° and dips 38° to the north. Deflection of cleavage into the shear fabric suggests a dextral component of strike-slip movement.

The dimensions, the attitude and the geometry of the sulphide zone are unknown. The zone seems to have an easterly trend, as suggested by a sheared semimassive sulphide band observed in trench No. 3, which is on strike with a similar band in trench No. 6. Assuming an easterly trend, the zone is a minimum of 285 m long, and is perhaps as long as 700 m judging by the position of the trenches, and is a minimum of 40 m wide.

The airborne electromagnetic and magnetic survey flown for the Ontario Geological Survey in 1988 (Ontario Geological Survey 1980a, 1980b) indicates a point source magnetic high coincident with the occurrence. An easterly trending array of magnetic highs, some of which some are coincident with electromagnetic anomalies, can be traced over a distance of 6 km. Two kilometres east of the Glatz occurrence, a narrow, north-trending magnetic anomaly, which is here interpreted to represent the extension of a diabase dike (Satterly 1943), is left-deflected by this easterly structural trend for a distance of 90 m.

Because the sulphide minerals at the Glatz occurrence have been shown to be coincident with strong magnetic anomalies, further exploration should include detailed magnetic and HLEM surveys. The identification of an east-trending array of magnetic highs, over a 6 km distance, extends the potential of finding additional nickel-copper occurrences, and perhaps also gold.

RESEARCH BY KENORA RESIDENT GEOLOGIST'S STAFF

GOLD STUDIES IN THE MANITOU-STORMY LAKES BELT

Introduction

This report summarizes the results of the investigation of some of the gold occurrences in the general Dryden area (Figure 2.2) during the 1989 field season. The project continues work initiated by J. Parker (Blackburn et al. 1988, 1989; Parker and Perrault 1988). In 1989, field work was concentrated in the vicinity of Lower Manitou Lake (Figure 2.5), and also in the vicinity of Kawashegamuk Lake, south of Dyment, to define: 1) relationships between the gold occurrences and their host rocks; 2) alteration and metamorphism; 3) sulphide composition; and 4) structure. Preliminary observations, an account of the mineral exploration history and previous geological work in the area, and a more detailed account of the Sakoose mine and Maw occurrences, were given in the Ontario Geological Survey's *Summary of Field Work and Other Activities 1989* (Delisle and Perrault 1989).

The present investigation led to the rediscovery of the locations of the Queen Alexandra mine (Figures 2.2 and 2.5, Table 2.3, number 41) and the Queen Alexandra Northern occurrence (40), both with the help of M. Woitowicz; the King Edward occurrence (29), the A-212 occurrence (1) and the HW-479 occurrence (28), with the help of A. Kozowy. Also in 1989, the S-500 occurrence (44) was relocated by B. Barton, the Copeland mine (16) by Venturex Resources Ltd. and Nexus Resource Corporation personnel, and the Gold Standard G-340 (24) occurrence by R. Fairservice. New occurrences were also discovered: the Barton occurrence (18) by B. Barton, and a few occurrences east of the Gold Standard G-340 occurrence by Canhorn Mining Corporation.

General Geology

The area under discussion (Figure 2.5) is part of the Manitou-Stormy lakes greenstone belt, an assemblage of metavolcanic and metasedimentary rocks which trends in an easterly direction, and extends for a distance of approximately 80 km from Lower Manitou Lake in the west to Bending Lake in the east (Blackburn 1981).

Blackburn (1982) has applied stratigraphic terminology to the greenstone belt rocks northeast of Lower Manitou Lake. Mapping by Berger (1988), and by Smith and Stephenson (1988), has more clearly defined the supracrustal rocks southwest of Lower Manitou Lake, enabling an extension of Blackburn's (1982) terminology into that area (Figure 2.5).

The geological succession northwest of the Manitou Straits fault differs from that to the southeast. Northwest of the fault, the metavolcanic rocks consist of three sequences: a lower, tholeiitic, mafic flow sequence, the Blanchard Lake group; a middle sequence of predominantly calc-alkalic, intermediate pyroclastic rocks, the Upper Manitou Lake group; and an upper, mixed calc-alkalic to tholeiitic sequence of mafic flows and intermediate pyroclastic rocks, the Pincher Lake group. The supracrustal assemblage has been intruded by granitoid rocks of the Atikwa batholith, which has imposed a contact metamorphic aureole of amphibolite grade up to 3 km wide upon the surrounding rocks.

Southeast of the fault, the metasedimentary and metavolcanic rocks constitute two sequences in the area under discussion: a basal sequence of tholeiitic mafic flows with minor amounts of metasedimentary rocks of the Wapageisi Lake group, that faces homoclinally to the northwest, and an overlying sequence of calc-alkalic intermediate pyroclastic and metasedimentary rocks of the Manitou group. The supracrustal assemblage has been intruded by the Irene-Eltrut lakes batholith complex, and the Bretz Lake, the Taylor Lake and the Scattergood Lake stocks.

All the supracrustal rocks are intruded by numerous northeast-trending felsic dikes, sills and small elliptical felsic plugs and stocks (Figure 2.5).

Structural Geology

The two major structures in the area are the Manitou Straits fault and the Manitou anticline (Figure 2.5).

The Manitou Straits fault strikes northeasterly from Manitou Stretch to Upper Manitou Lake and is a regional feature extending northeast to Dinorwic Lake, and to the west to connect with the Pipestone-Cameron fault (Blackburn 1981). The Manitou Straits fault is a zone, 60 m or more wide, of highly schistose and fissile

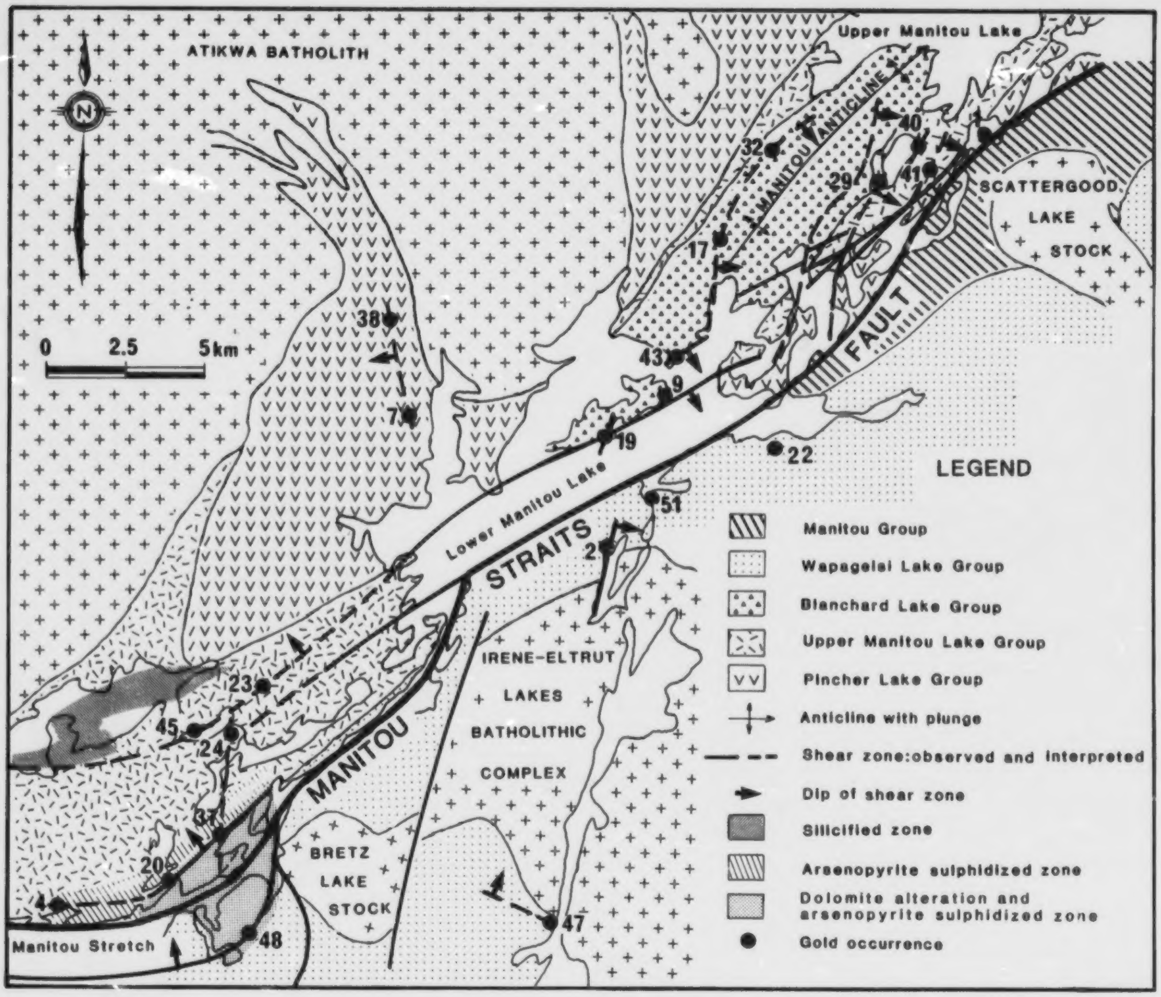

ATIKWA BATHOLITH
N
0
2.5
5km
Upper Manitou Lake
MANITOU ANTICLINE
SCATTERGOOD LAKE STOCK
FAULT
Lower Manitou Lake
STRAITS
MANITOU
IRENE–ELTRUT LAKES BATHOLITHIC COMPLEX
BRETZ LAKE STOCK
Manitou Stretch
38
7
32
17
29
40
41
43
9
19
22
51
2
23
45
24
37
20
4
48
47
LEGEND
Manitou Group
Wapageisi Lake Group
Blanchard Lake Group
Upper Manitou Lake Group
Pincher Lake Group
Anticline with plunge
Shear zone:observed and interpreted
Dip of shear zone
Silicified zone
Arsenopyrite sulphidized zone
Dolomite alteration and arsenopyrite sulphidized zone
Gold occurrence

Figure 2.5. Geology and gold occurrences, Lower Manitou Lake area.

rocks. The majority of the metavolcanic rocks northwest of the fault have been variably sheared. Shear zones separated by less sheared rock parallel the fault and many splays extend from the main deformation zone. Strike-slip movement can be attributed to the Manitou Straits fault, but steep lineations in the area indicate a predominance of vertical strain along the fault zone. Two sets of late cross-faults, a predominant north-northeast-trending set, and a weakly developed east-trending set, postdate the Manitou Straits fault (Blackburn 1976).

The Manitou anticline, northwest of the Manitou Straits fault, is an overturned anticline in which both limbs and axial plane dip to the southeast, and the fold axis strikes northeast, plunging to the northeast or east at a moderate angle (Blackburn 1982).

Characteristics of Gold Occurrences

The characteristics of 31 gold occurrences investigated during the 1989 field season are summarized in Table 2.5. The gold occurrences are either found in quartz veins hosted in shear zones, or in narrow semimassive sulphide bands filling fissures, or in shear zones with or without quartz veins. Shearing exhibits a brittle-ductile style of deformation and occurs in wide to narrow zones of schistose or fissile, ferroan-carbonate-altered rock. Rock type plays no part in determining whether the occurrences are of shear-hosted quartz vein type, fissure-filling type, or shear zone type. All of the types occur within major (northeast-trending) and minor (north-northeast- and east-trending) structures. Felsic dikes occur with or in proximity to 12 of 31 gold occurrences, and were emplaced either during or after shearing. The role of the felsic dikes was to provide a strong competency contrast between adjacent rock types, providing a setting for gold-bearing, shear-hosted veins in the strongly sheared wall rock at the contact with the less deformed felsic dikes. It cannot be demonstrated that the dikes are the source for the gold. In only a few cases are the felsic dikes slightly anomalous in gold.

TABLE 2.5. CHARACTERISTICS OF INVESTIGATED GOLD OCCURRENCES, DRYDEN AREA.

Occurrence Name (Map No.)	Trench, Vein, or Shaft	Host Rock	Alteration/ Metamorphism	Sulphide		Gold Assay (oz/T)	Shear Trend and Dip	Accessory Minerals
				Major	Minor			
S–500 (44)	Vein 1	quartz-diorite	ank	py	cp	0.134	015/86 W	calcite
	Vein 2					0.237		
	Vein 3					1.88	120/85 W	
Barton (8)		quartz-diorite	ank	–	py,cp VG	0.189	066/84 N	
Black Fox (10)		meta-gabbro	---	–	py	50 ppb	125/85 E	
Sakoose (46)		basalt, QFP	iron carbonate	–	py,cp Sp,bn gn,po VG	0.04	050/85 S	calcite
Maw (31)		sed, QFP	iron carbonate	–	py,cp po	0.08 0.098(w)	010/76 W	calcite
Copeland Mine (16)	Vein 1	felsic dike, basalt	ank, dol, (fu), S (bleaching)	py	po	40 ppb	010/53 W	calcite
	Vein 2							
	Vein 3					28 ppb	120/?	
Lee Lake (30)		QFP	ser, iron carb	py cp	VG	0.34	140/90 E	calcite
A–212 (1)		basalt	chl, carb	–	py	15 ppb	050 (?)	calcite
Queen Alexandra Northern (40)		grano-diorite	---	py gn	–	60 ppb	030/75 E	
King Edward (29)		gran-diorite	cc	py	gn, cp,bn	0.014	030/56 E	
Merrill (32)	Vein 1	basalt	chl,cc,S, bio,anth,si, hb	py	–	0.127 0.061(w)	052/55 S	calcite
	Vein 2					225 ppb	030/65 S	

Quartz Vein			Minimum Shear Length (m)	Shear Classification	Shear Classification
Texture & Structure	Width (cm)	Length (m)			
patches, ribbons	10–15	27	27	dex oblique	central shear
	16	12			
	10	225	225	sin strike-slip	extension vein
patches, pinch & swell	1–7	16	50	??	shear vein
ribbons	10–170	24	??	dex movement	quartz plug & shear vein
ribbons fractures, patches	20–650	240	390	dex strike-slip & sin oblique slip (Ssd)	Z-type central & extension shear vein
fractures, patches	20–180	260	1660	sin strike-slip & sin oblique slip	saddle-reef & shear vein
replacement ribbons, patches	50–200	75	1460(?)	Wsd dip-slip & sin strike-slip	central shear vein
	??	??	15		extension shear vein
ribbons	4–56	15	15	Wsd dip-slip	central & oblique shear veins
ribbons	??	??	??	??	??
sugary	80	2.25	13	??	shear vein
	70	??	??	??	shear vein
ribbons, xenoliths, patches,	150–280 veins	35	85	dip-slip	central shear
fractures	??	335	335	sin strike-slip	

TABLE 2.5. CONTINUED.

Occurrence Name (Map No.)	Trench, Vein, or Shaft	Host Rock	Alteration/ Metamorphism	Sulphide		Gold Assay (oz/T)	Shear Trend and Dip	Accessory Minerals
				Major	Minor			
Dryden–Red Lake Syndicate (17)		basalt	carb, mi,hb, plag	po	py	0.658 0.048(w)	020/40 E	calcite tourmaline
Royal Sovereign Mine (43)		basalt	chl,carb	po	cp	0.019 0.061(w)	048/62 S	tourmaline calcite
Beehive Mine (9)	Vein 1	basalt	chl,carb	py	cp	tr	080/69 S	calcite
	Vein 2 Vein 3					0.538 0.887	070/75 S 170/60 E	tourmaline
Gaffney (19)	Trench 9	quartz–diorite	iron carb, S, chl	py	cp	0.103(w)	070/75 S	calcite
	Trench 4 Trenches D, E, F					0.044(w) 0.041	020/82 E	
Glass Reef (22)		QP	ank, ser	po	py cp	46 ppb	055 (?)	calcite
Weasel (51)	Vein 1 Vein 2	chert	---	py	--	0.255 0.534	050/85 S	
Aronson Lake (2)		sed	gossan	py	cp po	0.10 0.57(w)	030/82 E	
Petrie (38)		mafic/ felsic rock	hb schist	--	--	----	175/80 W	
Barker Brothers Mine (7)		basalt flow	hb schist	py	po cp	0.694 1.013(w)	170/87 N	calcite hornblende
Gold Standard W–271 (23)		mafic rock	chl,ser,ank, cc,(sil), (S)	py	cp bn	0.077	045/40 N	calcite muscovite tourmaline

Quartz Vein			Minimum Shear Length (m)	Shear Classification	Shear Classification
Texture & Structure	Width (cm)	Length (m)			
boudins, ribbons	10–40	72	910	dex strike–slip	central shear vein
fractures	??	??	??	Nsd dip–slip	central shear vein
ribbons, fractures	40	42	42	sin strike–slip & Nsd dip–slip	shear vein
	80	??	??		
	60				extension vein
ribbons	N/A	N/A	335	dex oblique slip	fracture–filling shear with sulphide and quartz
	N/A	N/A	70		
	N/A	67	110	sin strike–slip	
ribbons, patches, fractures	??	??	1350	??	shear vein
sugary	5	??	??	Nsu dip–slip	shear vein
----	11	20	1270	sin strike–slip	vein & MASU filled shear
----	50–580	80	80	dex strike–slip	shear vein
ribbons, xenoliths	10–40	375	375	dex oblique slip	central shear vein
ribbons, contortion	zone of 150–250	35	35	Nsd dip–slip	shear vein

TABLE 2.5. CONTINUED.

Occurrence Name (Map No.)	Trench, Vein, or Shaft	Host Rock	Alteration/ Metamorphism	Sulphide		Gold Assay (oz/T)	Shear Trend and Dip	Accessory Minerals
				Major	Minor			
Gold Standard G-340 (24)		pillowed andesite	ank,chl,ser, (fu)	--	py	50 ppb	N-S	calcite muscovite
Sairey Gamp (45)		mafic rock	ser,chl, iron carb	--	py	6 ppb	075/90 S	calcite muscovite
Peep Bay (37)	Trenches 1,3,4,10	gabbro	ank, S, dol, calc,	Asp	py	0.177	045/N	calcite (muscovite)
	Trenches 5a,6a,6,9	pillowed andesite				0.047	040/75 N	
	Trenches 5b,5c				0.084	160/66 E		
	Trench 8					0.097	030/N	
Gates Lake (20)	Trenches 2,3,3a,4,5	gabbro	ank, S	Asp	py	0.157	055/74 N	calcite muscovite
Austin (4)		dacitic tuff	ser, S, K	Sb Asp	py	120 ppb	090/70 N	muscovite
Sorry Mac (48)	Trench C	basalt	dol,ank,ser, chl,(fu),	Asp	py cp	0.34	030/80 N	tourmaline calcite
	Trench B		(bleaching)		po	0.047		
	Trench D					445 ppb		
	Trench E					0.082		
Smooth Rock Lake (47)		pillowed basalt	limonite, S, (si), ep	po py	cp,mo sp,	0.914 1.219(w)	115/85 N	(calcite) (hematite)
Queen Alexandra Mine (41)	Vein 1	mafic rock	chl,(calc)	py	---	2.24	080/90 S	calcite
	Vein 2			py	cp	0.46	030/90 E	

Quartz Vein			Minimum Shear Length (m)	Shear Classification	Shear Classification
Texture & Structure	Width (cm)	Length (m)			
ribbons, fractures	zone of 300	??	??	??	shear vein
fractures, patches	??	??	??	dip-slip	shear vein
----	3 zones of 150–900	N/A	330	sin strike-slip & Nsd dip-slip	central shear fracture or vein
ribbons, patches	50–450	150	150	fissile zone	
fractures	12–80	50	50		S-sigmoidal extension vein
ribbons, fracture	??	80	80		
ribbons, fractures	2 zones of 250–500	??	30 122	fissile zone	MASU filled shears
fractures	9–80	76	76	Nsu dip-slip	shear vein
ribbons, breccia, replacement	900	N/A	1700	fissile zone	MASU filled shears & shear veins
	370		325		
	??		1700		
sugary, ribbons, patches	14–120	550	1250	dex movement	Z-type oblique & extension shear vein
ribbons, fractures	10	5	5	??	shear vein
	10–50	23	23	dex strike-slip	

TABLE 2.5. CONTINUED.

Occurrence Name (Map No.)	Trench, Vein, or Shaft	Host Rock	Alteration/ Metamorphism	Sulphide		Gold Assay (oz/T)	Shear Trend and Dip	Accessory Minerals
				Major	Minor			
Giant Prospect (21)	West Shaft	sed	chl,bio, ser	py	VG	0.59	070/85 S	calcite muscovite
	East Shaft					215 ppb		
HW-479 (28)	Vein 1	basalt flow	---	cp	po,bn	530 ppb	110/74 N	calcite
	Vein 2			–	cp	2 ppb	120/74 N	

Quartz Vein			Minimum Shear Length (m)	Shear Classification	Shear Classification
Texture & Structure	Width (cm)	Length (m)			
ribbons, fracture, patches	30–60	12	1500	dex strike-slip	oblique shear vein
	10–125	220			
fracture, patches	20–100	32	32	sin oblique slip	oblique, central & extension shear vein
	20–50	11	11		

(hornb: hornblende; carb: carbonate; plag: plagioclase; chl: chlorite; calc: calcite; ank: ankerite; dol: dolomite; sulph: sulphide; sil: silica; ser: sericite; fusc: fuchsite; anth: anthophyllite; bi: biotite; FK: potassic; () minor constituent; py: pyrite; cp: chalcopyrite; ga: galena; sph: sphalerite; bo: bornite; mal: malachite; VG: visible gold; po: pyrrhotite; gold assays: (1), (2), (3): vein 1, vein 2, vein 3; (w) wall rock assay; p: pending; dex: dextral; sin: sinistral; Nsd: north side down; Wsd: west side down; Nsu: north side up; M.S.: massive sulphide). Numbers in parentheses following occurrence names are keyed to Figures 2.2 and 2.5, and Table 2.2.

The structural history is complex in the Manitou Lake belt. The trend surfaces of all the northeast-trending shear zones define helicoidal shapes, such that they dip to the northwest in the vicinity of the Manitou Stretch, and to the southeast at Lower Manitou Lake. Fabric orientation and kinematic indicators (Robert 1987; Hodgson 1989), such as the rotation of "S" fabric into "C" fabric (Figure 2.6, feature 2) and extensional veins (Figure 2.6, feature 10), sigmoidal extension veins (Figure 2.6, feature 11) and oblique vein arrays (Figure 2.6, feature 8), indicate that strike-slip movement occurred along the Manitou Straits fault. However, shallow lineations that would substantiate this interpretation are difficult to detect because they have been masked and overprinted by later, steep lineations which characterize the whole area. These later lineations, in conjunction with other kinematic indicators, suggest that dip-slip movement postdates strike-slip movement, and was responsible for south-side-up movement to the northwest of the Manitou Straits fault, and north-side-up movement to the southeast, resulting in a structure that is similar to the "palm tree structure" described by Ramsay and Huber (1987, p.529). The same pattern of dip-slip shearing superimposed on earlier strike-slip shearing is also present in the east-trending shears. However, the north-northeast-trending shears display only strike-slip movement, both dextral and sinistral.

Figure 2.5 shows the spatial relationship of the studied gold occurrences to the shear zones. Most of the shear zones shown in Figure 2.5 are compiled from Blackburn (1976), Berger (1988) and Smith and Stephenson (1988). Others have been interpreted by the author from the trend of shear observed at individual occurrences.

VEIN GEOMETRY

The geometry of quartz veins that "pinch and swell" is dependant on the style of deformation. Strike-slip shearing in the area has resulted in the following vein geometries: a) oblique veins, connected with extension veins (Figure 2.6, feature 9), such as at the Smooth Rock Lake occurrence (Figure 2.5, location 47), Sakoose mine (Figure 2.2, location 46) and HW-479 occurrence (Figure 2.2, location 28); b) *en échelon* oblique veins (Figure 2.6, feature 8), such as at the Giant prospect (Figure 2.2, location 21); c) sigmoidal extension veins (Figure 2.6, feature 10), such as in trenches 5A and 5C at the Peep Bay occurrence (Figure 2.5, location 37); d) extensional veins external to shear zones (Figure 2.6, feature 6), such as vein No. 3 at the S-500 occurrence (Figure 2.2, location 44), and; e) short, microextensional fractures (Figure 2.6, feature 4), such as those filled with sulphides at the Gaffney deposit (Figure 2.5, location 19), and at the Gates Lake occurrence (Figure 2.5, location 20). The quartz veins are commonly folded into "S" or "Z" shapes as seen on horizontal surfaces, such as at the Queen Alexandra mine (Figure 2.5, location 41); contorted, such as at the Gold Standard HW-271 occurrence (Figure 2.5, location 23); or boudinaged, such as at

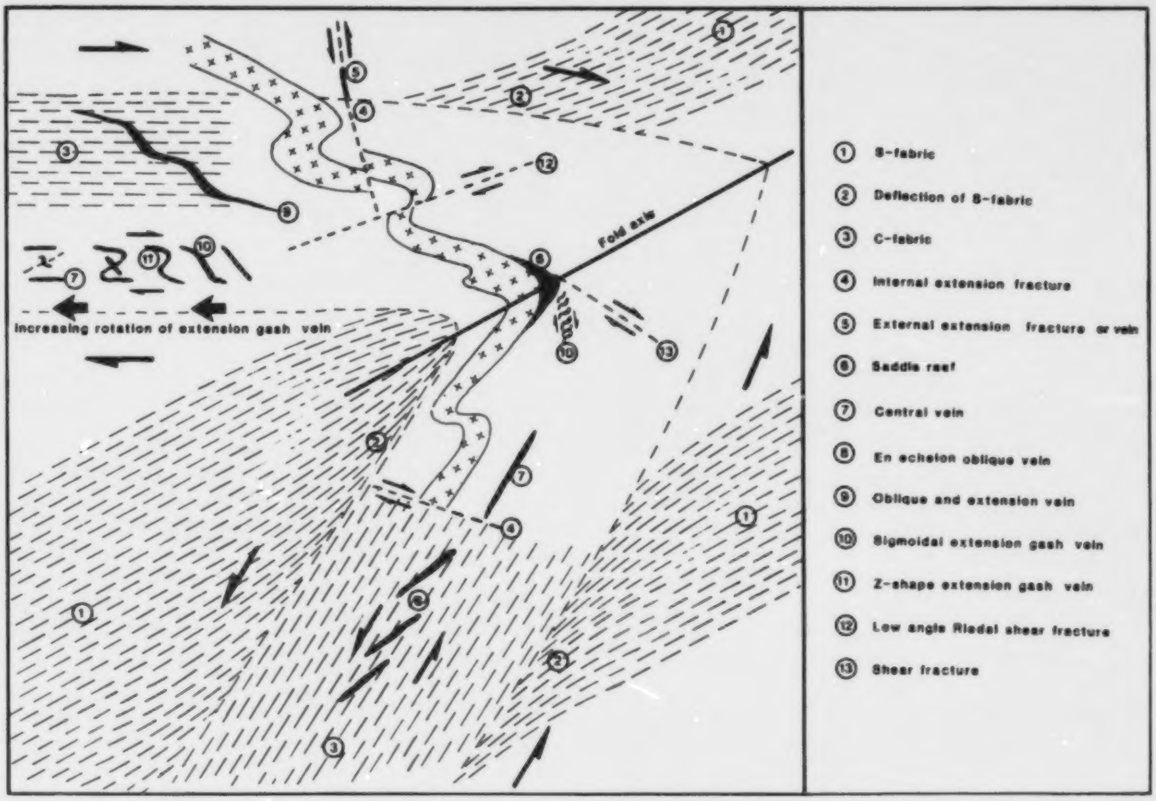

Fold axis
Increasing rotation of extension gash vein
① S-fabric
② Deflection of S-fabric
③ C-fabric
④ Internal extension fracture
⑤ External extension fracture or vein
⑥ Saddle reef
⑦ Central vein
⑧ En echelon oblique vein
⑨ Oblique and extension vein
⑩ Sigmoidal extension gash vein
⑪ Z-shape extension gash vein
⑫ Low angle Riedel shear fracture
⑬ Shear fracture

Figure 2.6. Schematic of common vein and fabric geometries.

the Dryden Red Lake occurrence (Figure 2.5, location 17).

Conjugate systems of quartz veins are present at the S-500 occurrence, at the Copeland mine (Figure 2.2, location 16), at the Gaffney deposit and at the Queen Alexandra mine. The Maw occurrence (Figure 2.2, location 31), described by Delisle and Perrault (1989), is a fold-related saddle-reef type (Figure 2.6, feature 6).

Dip-slip shearing has resulted in the rotation of earlier quartz veins and of shear zones. It has modified the steep dip of shear zones, and quartz veins can be seen to be folded on vertical planes, such as at the Austin occurrence (Figure 2.5, location 4) and at the Beehive mine (9). It is also responsible for flat-lying quartz veining such as at the Gates Lake occurrence (20), at the Peep Bay occurrence (37) and at the Sakoose mine.

DEPOSIT TYPES

1. Gold-bearing quartz veins: this is the most common type encountered throughout the Manitou–Stormy lakes greenstone belt. All of these veins share the same two characteristics: 1) wispy to well-layered ribboned texture with layers of sericite and/or chlorite and/or iron carbonate and/or sulphide, and more rarely, tourmaline, and 2) calcite-filled fractures.

Because quartz veins are commonly of "crack and seal" type, gold is commonly found along the contact of the vein and its immediately adjacent wall rock, in addition to within the vein.

Some occurrences display replacement texture, such as in trench C at the Sorry Mac occurrence (48), and at the Copeland mine, and a few have a breccia texture such as in trench E at the Sorry Mac occurrence. The gold distribution and the alteration zonation for the replacement texture exposed in trench C at the Sorry Mac occurrence are, from the footwall to the hanging wall: 1) 7 m of weak to moderate, iron carbonatized and chloritized metabasalt; 2) a 0.25 m wide bleached zone with 1 percent arsenopyrite and pyrite and traces of chalcopyrite, which returned a gold value of 160 ppb; 3) a 3 m wide, fissile zone which dips 25° to the north, and is characterized by pervasive ankerite and dolomite alteration, and has been injected by a few concordant quartz veinlets containing up to 25 percent sulphide (arsenopyrite > pyrite), including a few semi-massive bands, a sample of which returned an assay result of 0.34 ounce gold per ton; and 4) a 6 m wide mixed zone of dolomite + fuchsite + ankerite + quartz, with minor amounts of wall rock that returned a gold value of 190 ppb. The latter zone shows many very closely spaced extension quartz veinlet arrays and some central shear veins, resulting in a stockwork in which the quartz material is weakly brecciated. This quartz material returned no gold values on assay.

2. Gold-bearing, narrow, semimassive sulphide bands: this type of deposit is specific to the Sorry Mac occurrence (48), the Gates Lake occurrence (20), trenches 1, 3, 4 and 10 at the Peep Bay occurrence (37), and the Aronson Lake occurrence (2). In the first three of these occurrences, gold occurs in a strongly iron carbonatized (ankerite, dolomite) fissile zone. These sulphidized gold-bearing zones consist of disseminated sulphides to semimassive sulphide bands up to a few centimetres thick. If quartz veinlets and veins occur in the anastomosing fissile zone, they usually have a low tenor in gold.
3. Gold-bearing shear zones with or without quartz veins: some shear zones that host gold-bearing quartz veins contain gold in the sheared wall rock. This is the case at the Barker Brothers mine (7) where the hornblende-plagioclase schist yields high gold tenors. Two grab samples taken by the author returned assay results of 1.103 ounces gold per ton and 0.843 ounce gold per ton. The shear zones at the Smooth Rock Lake occurrence (47), the Aronson Lake occurrence (2), the Merrill claims (32), the Dryden–Red Lake occurrence (17) and the Gaffney deposit (19) yielded erratic gold values. At the Smooth Rock Lake occurrence, gold is associated with pyritized chlorite-epidote schist. Two of seven grab samples returned assay results of 1.219 ounces gold per ton and 0.093 ounce gold per ton. At the Aronson Lake occurrence, a grab sample of gossanous chert returned an assay result of 0.57 ounce gold per ton. Three other grab samples gave anomalous gold values on assay. At the Merrill claims, one of five grab samples from the pyritized chlorite-biotite schist returned an assay value of 2090 ppb gold. At the Dryden–Red Lake occurrence, one of three grab samples from the pyritized hornblende-mica-calcite-plagioclase schist returned an assay result of 0.048 ounce gold per ton. At the Gaffney deposit, two grab samples from the pyritized quartz diorite returned values of 0.103 and 0.044 ounce gold per ton, respectively.

SULPHIDE ASSOCIATION

The most common sulphides associated with gold in the area, in decreasing order of importance, are pyrite, chalcopyrite, arsenopyrite, pyrrhotite, sphalerite and galena. Visible gold was noticed at some occurrences (Table 2.5). Rock geochemical analyses indicate that amount of gold in quartz veins is neither related to total sulphide content nor to any specific sulphide species. However, there are a few exceptions. There is a strong relationship between amounts of gold and copper at the Beehive mine (9) and at the Queen Alexandra mine (41), and between amount of gold and total sulphide content at the Gold Standard HW-271 occurrence (23) and at the Beehive mine.

Amount of gold is strongly related to total sulphide content in narrow, gold-bearing, semimassive sulphide bands, except at the Aronson Lake occurrence (2). In addition to the sulphide correlation, the Peep Bay occurrence (37) shows an association between amounts of gold and arsenic. Also, geochemical analyses of samples collected by Berger (in preparation) show a good correlation between amounts of gold and stibnite at the Peep Bay occurrence and at the Gates Lake occurrence.

Gold-bearing shear zones with or without quartz veins show a good association between amounts of gold and sulphide.

Silver is present in some cases, such as at the Smooth Rock Bay occurrence (47), the King Edward occurrence (29), the S-500 occurrence, the Aronson Lake occurrence (2), the Weasel occurrence (51) and the Barker Brothers mine (7). The King Edward occurrence and Queen Alexandra Northern occurrence (40) are low-grade silver deposits associated with lead. The best assay result from grab samples taken from the King Edward occurrence was 115 g/t silver and 0.34 percent lead, and at the Queen Alexandra Northern occurrence 35 g/t silver and 0.41 percent lead.

ALTERATION PRODUCTS

Each gold occurrence has a unique alteration pattern. The common and broad alteration product is iron carbonate. Other alteration products are, in decreasing order of importance, chlorite, calcite, sericite, iron sulphide, mica (including fuchsite), silica and anthophyllite.

West of the Bretz Lake stock, the Sorry Mac occurrence (48), the Peep Bay occurrence (37; trenches 1, 3, 4 and 10) and the Gates Lake occurrence (20) all have a common alteration pattern which is dissimilar to that of other occurrences in the Lower Manitou Lake area, and is characterized by addition of dolomite and arsenopyrite. Sulphidization (arsenopyrite, pyrite) is widespread, whereas dolomitic alteration is confined to shear zones (Figure 2.5). The style of gold setting is also unique and consists of shear-hosted, gold-bearing, narrow, semimassive sulphide bands, as described previously. This style of occurrence, as well as the specific alteration assemblage, is restricted to the Manitou Stretch over a known length along the Manitou Stretch of 2 km and width of 3 km.

DELINEATION OF THE TREND OF GOLD-BEARING STRUCTURES

Field work at the Sakoose mine and Maw occurrences (Delisle and Perrault 1989), and the recent relocation of old occurrences, namely the Copeland mine, the HW-479 occurrence and the HW-476 occurrence, suggests a major structural trend containing narrow shear zones injected by felsic dikes (Figure 2.7). This gold-bearing structure connects with another to the south (the Church Lake occurrence, the Brockman prospect and the Brown Lake occurrence) which was

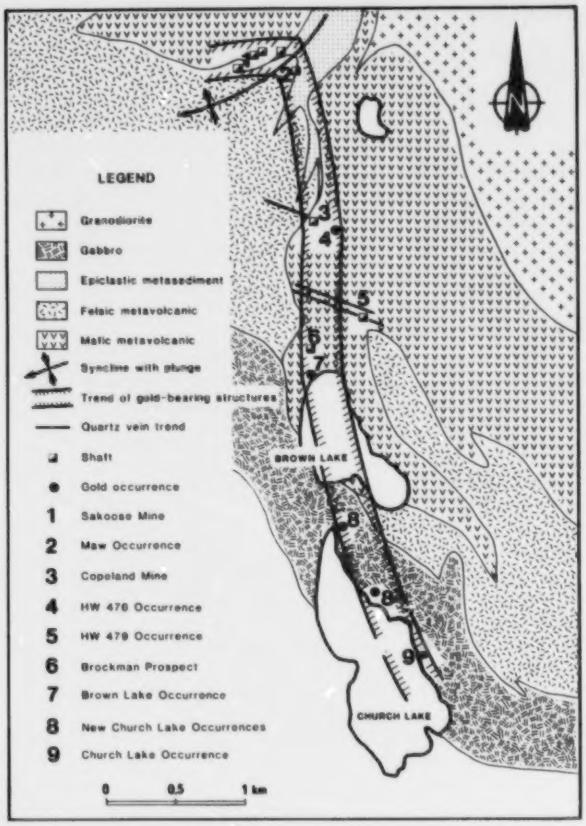


Figure 2.7. Trend of gold-bearing structures, Church Lake area.

recognized in 1984 by geologists working for Teck Corporation (Assessment Files, Kenora Resident Geologist's office). At least three north-trending shear zones are known within the major structural trend, over a minimum strike length of 5.5 km and a minimum width of 140 m. The shear zones in the north-trending structural zone show evidence of sinistral strike-slip movement and east-side-down dip slip, whereas shear zones in the small east-trending structural zone at the north end of the envelope show evidence of dextral strike-slip movement. A set of west-northwest-trending, north-dipping quartz veins crosscut the major trend at the HW-479 occurrence, and at the Copeland mine. The alteration products consist of pervasive iron carbonate, and chlorite, sericite, fuchsite and talc. Pyrite, chalcopyrite, sphalerite, pyrrhotite and galena are the common sulphides associated with the structural trend. Visible gold is commonly present, but gold values are erratic and not correlated with sulphide content.

Saddle-reef type quartz veins occupying fold noses are characteristic of the Maw occurrence (Delisle and Perrault 1989), and others are to be expected in the same area, particularly along and near the metasedimentary-metavolcanic contact. Similar situations could occur along the contact between mafic and felsic metavolcanic rocks from the Copeland mine to the Brockman prospect.

Conclusions

Gold occurrences in the Manitou–Stormy lakes greenstone belt are of three types: 1) shear-hosted quartz veins; 2) shear-hosted, narrow, semimassive sulphide bands; and 3) altered shear zones with or without quartz veins. The three types are found in all rock types, and within the northeast-, north-northeast and east-trending faults that characterize this portion of the Manitou–Stormy lakes greenstone belt. The presence of gold is generally erratic in shear-hosted quartz veins, and is believed to occur in the free state because it shows no relationship between the amount of sulphide or any specific sulphide. However, there is a correlation between gold and sulphide content in semimassive sulphide bands and sulphidized shear zones with or without quartz veins. The "crack and seal" texture of the quartz veins indicate that they formed as open space fillings. The veins were emplaced during the earlier strike-slip shearing, and continued to be emplaced through the later dip-slip shearing, so that overprinted shearing has imparted complex geometries to the quartz veins.

Recommendations

The high-grade, gold-bearing, hornblende-plagioclase schist in the Barker Bay area, Lower Manitou Lake, is surprising because of the lack of sulphides and alteration in the sheared rock. The Barker Brothers mine (7) and the Petrie occurrence (38) should be reinvestigated in light of these new results and also because many old trenches were newly discovered during the present work, near the old Barker Brothers shaft. The whole area contains many north-trending hornblende-plagioclase bands up to a few metres wide, with or without quartz lenses and veinlets.

The specific alteration assemblage and style of mineral occurrence in the Peep Bay–Gates Lake area is localized in a dilatant zone of the Manitou Straits fault (Figure 2.5). A careful look should be taken at a similar structural environment that occurs at the junction of Lower Manitou Lake and the Manitou Stretch. It is interesting to note that dolomite alteration-filled shears and arsenopyrite-sulphidized zones occur at the inflexion of the Manitou Straits fault from a northeast trend to an easterly trend, at the southwest end of the Manitou Stretch, and that a silicified alteration zone occurs at the inflexion of an interpreted shear zone to the north (Figure 2.5). Smith and Stephenson (1988) noted a highly silicified area between Vista Lake and Dogfly Lake, south of the Bretz Lake stock (outside of Figure 2.5). A curve with a north-northwest trajectory can be drawn between all of these alteration zones and is the locus of the inflexion of all the structures. This area of inflexion should be investigated as a potential area for mineral occurrences.

It is probable that the shear zone between Gates Lake and Peep Bay extends to the northeast along the boundary between the Wapageisi Lake group and the

Upper Manitou Lake group, and this could also be a favourable area for mineral occurrences. The western extension of the same shear zone between the Austin occurrence (4) and the Gates Lake occurrence (20) should also be investigated.

Stripping of overburden should always be a priority at any occurrence, because it exposes the geometries of the veins and shear zones and allows prediction of their attitude. Detailed mapping of the stripped area will help to resolve structural complexity. A case in point is the Sakoose mine–Maw occurrence, where recent stripping enabled the extension and clarification of the setting of the mineralized zone and the definition of new exploration targets (Delisle and Perrault 1989).

GEOLOGICAL DATA INVENTORY FOLIOS

Compilation of Geological Data Inventory Folios (GDIFs) continued under COMDA funding during 1989. The program was started in 1985. By the end of 1989, 33 GDIFs had been released (*see* Figure 2.8); 12 more are in preparation and can be viewed at the Kenora Resident Geologist's office.

Most of the year was spent producing and updating GDIFs in the Dryden–Ignace area. A total of 21 GDIFs have been completed in this area, 13 of which have been published.

Toward the end of 1989, emphasis of coverage was shifted to the western part of Lake of the Woods, a historic gold camp which has seen renewed activity over the past decade. Four GDIFs are in preparation in this area.

Geological Data Inventory Folios provide a map-based index, not only to assessment files in the Kenora Resident Geologist's office, but to all other available mineral-related data in the area of coverage.

DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library serves three of the six Resident Geologist's districts in northwestern Ontario: Kenora, Patricia (Sioux Lookout) and Red Lake. Core stored consists of core from entire drill holes from both exploration and mine development drilling, incomplete core recovered from old drill sites, and short samples of core submitted for credit under Section 77(6) of the Mining Act, Revised Statutes of Ontario, 1980.

The current content of the library consists of 47370.1 m of completely catalogued core stored inside the building (28365.3 m from Kenora), and 19032.2 m of core in secure outdoor storage on pallets (13223.4 m from Kenora). Core in outdoor storage consists of excess core from several drilling projects that was collected in its entirety, core that has been removed from the racks inside the building, and surplus core, after some holes were relogged and reduced.

Use of the core library increased in 1989, with a total of 193 visits (165 industry and 28 government), compared to 151 in 1988, and 80 in 1987. A total of 91 man-days were spent by industry personnel examining and logging drill core and rock sample suites.

Core from a total of 363 drill holes in the Kenora district is stored in the main part of the collection, with core from another 124 holes in outdoor storage. A total of 6481.6 m of core from 74 diamond-drill holes was collected between November 21, 1988, and November 23, 1989. As in the other two districts, most of these holes were drilled for gold. Emphasis has been placed on collecting core from the more remote parts of the area, north and east of Red Lake and Sioux Lookout, and from areas of poor bedrock exposure. Further discussion of core collected in the Red Lake and Sioux Lookout districts can be found in Atkinson et al. (this volume) and Janes et al. (this volume).

Renewed emphasis on base metal exploration has led to the re-evaluation of core from several locations. Much of the diamond drilling prior to 1980 was carried out during base metal exploration. Condensed core from drilling in the Rainy Lake area by G. Armstrong during the early 1970s, and assessment credit core from Hudson Bay Exploration and Development Co. Ltd. and Kerr Addison Mines Limited, are some of the few remaining examples of this material on file at the Kenora Drill Core Library.

The core drilled by G. Armstrong was collected from 1976 to 1986 and condensed by H. Poulson, now of the Geological Survey of Canada. It consists of condensed core from drill holes through several base metal and gold occurrences in the Fort Frances–Rainy River area. Many of these occurrences have no other drill core extant. Hand specimen suites accompany some of this core.

The primary exploration target in the Kenora district is still gold. Of the 13 current industry drill projects from which core was collected this year (Table 2.4), all but two were directed toward gold. One of these was that of BP Canada Inc. at Entwine Lake, where the company investigated platinum group elements at the Jock Lake occurrence. The nine holes cut a pyrite-, pyrrhotite- and chalcopyrite-bearing zone hosted in coarse-grained porphyritic gabbro. The occurrence had been explored by Noranda Mines Ltd. in the early 1970s for its copper content, but no core from this work is available. M.R. Hailstone gives a description of the Jock Lake occurrence in Blackburn et al. (1989, p.38). The other non-gold project was that of Falconbridge Limited, who continued diamond drilling on their Rice Bay base metals project in Watten Township.

As part of a program of overburden drilling in the Rainy River area by the Ontario Geological Survey, a series of bedrock intersections were collected beneath 20 to 30 m of overburden. The area investigated has very sparse bedrock exposure and these cores are commonly the only bedrock samples available over wide areas. Bajc (1988) gave locations for these drill holes and details of the stratigraphy encountered.

The core collected from gold and base metal exploration diamond-drilling sites in 1989 was mostly on or

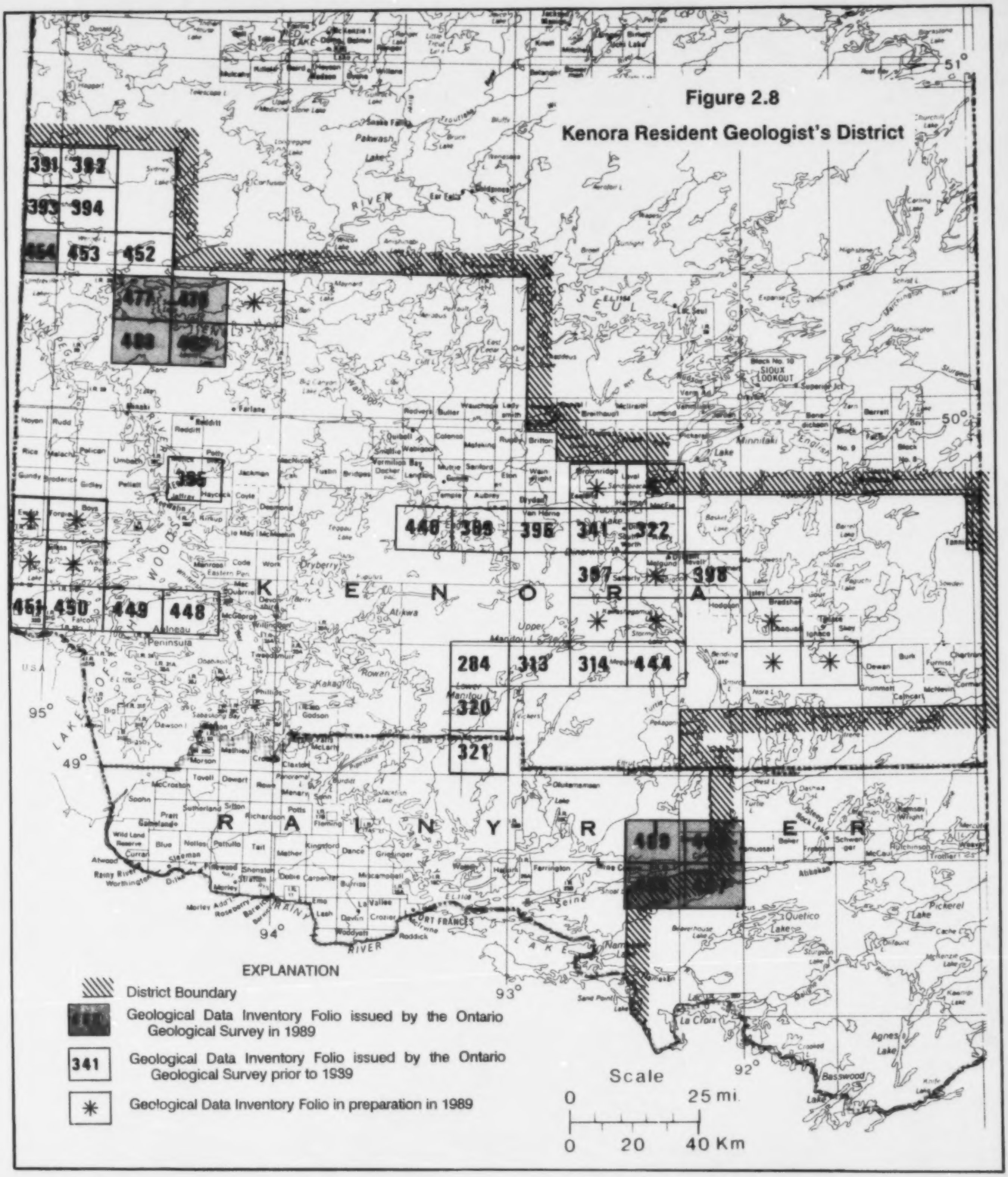


Figure 2.8

Kenora Resident Geologist's District

EXPLANATION
District Boundary
Geological Data Inventory Folio issued by the Ontario Geological Survey in 1989
341
Geological Data Inventory Folio issued by the Ontario Geological Survey prior to 1989
*
Geological Data Inventory Folio in preparation in 1989
Scale
0
25 mi.
0
20
40 Km
51°
50°
49°
95°
94°
93°
92°
391
392
393
394
454
453
452
477
478
488
395
440
389
396
341
322
387
398
451
450
449
448
284
313
314
444
320
321
489
K E N O R A
R A I N Y R I V E R
LAKE OF THE WOODS
SIOUX LOOKOUT
FORT FRANCES
Quetico Lake
Minnitaki Lake
Lac Seul
U.S.A.

near known occurrences or past-producing mines. The only exception to this is core from Asarco Exploration Co. of Canada Ltd.'s Pinewood project. Here, both reverse circulation and diamond drilling were done subsequent to the gold grain study by Bajc (1988).

RECOMMENDATIONS FOR EXPLORATION

Although major exploration emphasis in the Kenora Resident Geologist's District since the beginning of the 1980s has been for gold, base metals were the favoured target throughout the preceding two decades. The discovery of copper-zinc deposits at Sturgeon Lake, 80 km northeast of Ignace, in the 1960s led to prospecting and exploration for similar volcanogenic massive sulphides throughout the greenstone belts of the western Wabigoon Subprovince. Prior to this, magmatic massive sulphides, predominantly copper-nickel, had been sought in gabbroic intrusions.

BASE METALS

Base metals are again attracting attention, and although virtually all greenstone belts were explored in the former round of exploration, much of this work was based on anomalies detected by geophysics, using airborne techniques as the first pass. Because of this, numerous highly prospective areas were given only cursory attention. With the new detailed (1:15840) geological mapping done by the Ontario Geological Survey since that time in the Kenora Resident Geologist's District, the time is ripe for a new assessment of the base metal potential of specific areas.

Recent syntheses of regional geology (e.g., Blackburn et al. 1985) have attempted to assign specific geologic environments to suites of volcanic and sedimentary rocks. A subduction-related, mobilistic model is currently favoured. According to this type of approach, it should be possible to assign suites to one of a number of environments (Thurston and Chivers, in press), related to tectonic plate interaction. The Tectonic Map of Ontario, currently in preparation (Stott 1989), will greatly facilitate this approach.

While this theme cannot be developed in detail here, the stratigraphic setting of a number of lesser-explored areas that have potential for base metal deposits are discussed below, with the intent of pointing the way to areas for further prospecting, and for grass roots geological exploration programs.

Following his mapping of the Long Bay–Lobstick Bay area, Johns (1987) pointed out that the contact between mafic metavolcanic and clastic metasedimentary rocks in the Black Lake area, 35 km southeast of Kenora, appears to have been the locus of copper-zinc mineralization. The stratigraphic and structural setting of this area is described under the section on Black Lake Copper-Zinc Occurrence, in this report. Exploration in this area during the early 1970s by Dome Exploration (Canada) Ltd., Hudson Bay Exploration and Development Co. Ltd. and Kerr Addison Mines Ltd., following prospecting by M. Hupchuck of Fort Frances, led to the discovery of several copper-zinc occurrences.

In 1967, M. Hupchuck diamond drilled three short holes at Bug Lake for a total length of 82 m, in clastic metasedimentary rocks and minor gabbro dikes. One hole intersected pyrite, pyrrhotite, sphalerite and chalcopyrite (Assessment Files, Kenora Resident Geologist's office). A grab sample recently taken at surface at the same location gave the following results on analysis: 581 ppm Cu, 3110 ppm Zn and 1.7 ppm Ag (G. Zebruck, Prospector, personal communication, 1989).

In the same general area, Hudson Bay Exploration and Development Co. Ltd. carried out ground electromagnetic surveys near Doubtful Lake in 1976. Two holes were diamond drilled to test conductors north of the lake, close to the metavolcanic-metasedimentary contact. In one hole, a 2 m section of graphitic argillite and wacke, containing 5 to 30 percent pyrite and minor amounts of pyrrhotite, directly overlies metavolcanic rocks, while in the other hole a 13 m section of biotitic hornblende gabbro contained lenses of massive pyrite up to 5 cm wide (Johns 1987).

Johns (1987) interpreted the felsic metavolcanic rocks in this area to represent the distal portion of a composite volcano, overlying mafic flows which acted as a platform. He also suggested that sulphide minerals hosted by graphitic horizons that lie near or at the top of the mafic flows may represent hydrothermal vents of the "black smoker" type, and that they have been preserved by subsequent sedimentation. While to date such types of deposits have not been shown to contain significant amounts of base metals, they do represent a hitherto little-tested target. The metasedimentary sequence in the Long Bay–Lobstick Bay area lies near the western end of the Warclub group, and can be traced along strike to the east as far as Sioux Lookout, a distance of approximately 200 km, and to the west into the Cochrane Island area of Lake of the Woods. Its lower contact with metavolcanic rocks represents a good prospecting target for copper-zinc volcanogenic deposits. Easton and Johns (1986) have discussed volcanic facies associations in the Berry River formation, which lies within the predominantly epiclastic Warclub group, but to date has not yielded significant base metal occurrences.

Volcanogenic base metal occurrences of a different association lie within, but near the top of, the thick volcanic succession at Eagle and Wabigoon lakes. While the volcanic stratigraphy is not known in detail, mapping by Satterly (1943) and Moorhouse (1941), and further work by Trowell et al. (1980), has led to a three-fold stratigraphic subdivision in this area: a lower mafic platformal sequence (Eagle Lake volcanics); an overlying felsic flow and pyroclastic sequence (Lower Wabigoon volcanics); and a predominantly upper mafic flow sequence (Upper Wabigoon volcanics). Copper-zinc minerals have been discovered in two separate areas within the Upper Wabigoon volcanic rocks, possibly along strike from each other, at Wabigoon Lake by Euro-Dollar Development Ltd., and at Eagle Lake by International Platinum Corp.

From 1978 to 1982, Euro-Dollar Development Ltd. conducted a program of exploration that included geological mapping, geochemical, electromagnetic and magnetic surveys, diamond drilling in 22 holes for a total length of 17690 feet, and down-hole geophysical logging, in the vicinity of some small islands 3 km east of Copeland Island, Wabigoon Lake. While most of these drill holes intersected graphite or barren sulphides, chalcopyrite and sphalerite were logged in a number of holes, and in one hole a two-foot section in graphitic argillite on analysis gave values averaging 0.143 percent copper, 0.077 percent lead and 1.70 percent zinc (Assessment Files, Kenora Resident Geologist's office).

Commencing in 1986, International Platinum Corp. has conducted a gold and base metal exploration program at Eagle Lake. During diamond drilling at the Swanson gold occurrence in 1986, on the northeast shore of the largest body of open water on the lake, a nine-foot section of barren massive sulphide was intersected in one hole at a contact between mafic and felsic metavolcanic rocks. In 1987, prospecting by A. Kozowy led to the discovery of a zinc occurrence on the west side of Farabout Peninsula. Subsequent to geophysical surveys, further diamond drilling was done at two locations, one just northeast of North Twin Island, and the other east of Partridge Point. Geological mapping done by D. Conrad for International Platinum Corp. in 1988 better defined the rock types on the Farabout Peninsula, where the only previous mapping was done in 1939 (Moorhouse 1941). A 300 m wide felsic pyroclastic unit was mapped by D. Conrad within predominantly mafic metavolcanic rocks on the peninsula, and was found to be anomalous in zinc across its width, on analysis of the samples collected. D. Conrad points out the possibility that the sulphide-bearing rocks at the Swanson gold occurrence are part of a unit that can be traced through Partridge Point, and across the Farabout Peninsula to the zinc occurrence discovered by A. Kozowy (Assessment Files, Kenora Resident Geologist's office). Further targets were diamond-drill tested by International Platinum Corp. in 1989.

Although geologic continuity between Wabigoon and Eagle lakes is not well documented, the area having not been mapped since the work of Moorhouse (1941) and Satterly (1943), the discovery of two low-grade base metal occurrences within the Upper Wabigoon volcanic rocks, at similar stratigraphic levels, suggests that further exploration and prospecting be conducted in this unit.

GOLD

Traditionally, prospecting and exploration for gold in the Kenora Resident Geologist's District has been carried out in or adjacent to the greenstone belts of the Wabigoon Subprovince, and the Bee-Eagle lakes greenstone belt of the Uchi Subprovince. As a consequence, greenstone belts within the gneissic terrains have received little attention. One such belt, the Separation Lake greenstone belt, 55 km north of Kenora, is currently being explored, although up to the present only one company, Champion Bear Resources Ltd., has made a major commitment there.

The first indication of gold in this belt came from Umfreville Lake, at its west end, where according to a report by R. Thomson, Resident Geologist, Kenora, dated June 1948, A. Gauthier of Kenora discovered gold, along with zinc and other base metals, in a sulphide zone on a peninsula at Oneman Lake (now part of Umfreville Lake, subsequent to the rise in water levels resulting from the construction of a dam on the English River). Low gold assay values, up to 0.12 ounce gold per ton, were obtained from an arsenopyrite-rich sulphide zone (Mineral Deposit Files, Kenora Resident Geologist's office).

Gold was also discovered at Helder Lake, at the east end of the belt, where in a report dated September 1947, R. Thomson noted low gold assay values (up to 0.02 ounce gold per ton) from grab samples he collected at a sulphide occurrence that had been diamond drilled by H. Hawes of Kenora (Assessment Files, Kenora Resident Geologist's office).

The Gauthier occurrence at Umfreville Lake was examined by Sparton Resources Inc. in 1985 (Assessment Files, Kenora Resident Geologist's office), for both gold and base metal potential. The highest assay value obtained from samples taken at that time was 1155 ppb gold.

No further work was recorded on the Helder Lake occurrence subsequent to 1947, until recent years. Shabu Gold Mines Ltd. conducted ground geophysical surveys over a claim block at Helder Lake in 1987 (Assessment Files, Kenora Resident Geologist's office). Subsequently, an airborne survey was done over a large claim group and diamond drilling was done at the original Helder Lake occurrence, by Champion Bear Resources Ltd. in 1988, following the transfer of the property from Shabu Gold Mines Ltd. Encouraged by results of the diamond-drilling program, Champion Bear Resources Ltd. staked further claims along the length of the belt, as far as the Gauthier occurrence at Umfreville Lake, and conducted an airborne geophysical survey over the additional claim group in 1989. In the summer of 1989, the company prospected, stripped and sampled the Gauthier occurrence. Their work has substantiated gold values at both the Helder Lake and Gauthier occurrence (L. Chastko, consultant geologist, Winnipeg, personal communication, 1989). At the Gauthier occurrence, Champion Bear Resources Ltd. reported (press release, September 5, 1989) that continuous mineralization has been traced over a strike length of more than 1000 m and width of 100 m, and that assay values from grab samples were up to 0.70 ounce gold per ton, 1.87 ounces silver per ton and 4 percent zinc.

The presence of gold in sulphide-rich zones at two widely separated localities within the Separation Lake greenstone belt suggests that other occurrences may be found. Records suggest that the belt has not been thoroughly prospected in the past.

The east-trending greenstone belt along the boundary between the Wabigoon and Winnipeg River subprovinces near the town of Vermilion Bay, between Willard Lake in MacNicol Township and Wildrice Lake in Colenso Township, has been known for its uranium and base metal occurrences (Pryslak 1976). There are no known gold occurrences recorded in this greenstone belt. Recent sampling of tills as part of a three-year Quaternary geological mapping program by the Geological Survey of Canada under the Canada–Ontario 1985 Mineral Development Agreement (COMDA) (Cowan 1987; Minning 1988, 1989) has indicated that this belt may host hitherto undiscovered gold occurrences. A total of 219 samples of till were taken throughout the 25500 km² survey area for neutron activation analysis. Results for the less than 63 μm till fraction indicated geochemically anomalous values in all the portions of the greenstone belts known to host gold occurrences: in a population that produced background values of less than 4 ppb gold, each belt yielded one or two values in the greater than 13 ppb range. In the Willard Lake–Wildrice Lake belt, three samples yielded values greater than 13 ppb. The geochemical derivation of gold of this size fraction in till samples is not well understood, and the gold could be derived from sulphide bodies, rather than gold occurrences; however, these results do suggest that the Willard Lake–Wildrice Lake belt has the potential to host gold occurrences.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

During the year, one field party from the Precambrian Geology Section, Ontario Geological Survey, operated within the Kenora Resident Geologist's District, as shown in Figure 2.2. J.A. Ayer conducted detailed mapping (1:15840) of the Poplar Island area, Lake of the Woods.

RESEARCH BY OTHER AGENCIES

UNIVERSITY THESES

Geological theses relating to the Kenora Mining Division, believed to be in progress or completed during 1989, are as follows:

TABLE 2.6. MAPS AND REPORTS PERTAINING TO THE KENORA RESIDENT GEOLOGIST'S DISTRICT ISSUED BY THE ONTARIO GEOLOGICAL SURVEY, 1989.

Canada–Ontario Mineral Development Agreement (COMDA) Airborne Geophysical Maps	
21416G - 21444G	Total Field (1:20000)
41416G - 41444G	Vertical Gradient (1:20000)
C21445G - C21454G	Combined Residual Total Field/VLF–EM Total Field Profiles (1:50000)
C41445G - C41454G	Combined Vertical Gradient/VLF–EM Quadrature Profiles (1:50000)
Maps	
Map 5105	Northern Ontario Engineering Geology Terrain Study, Sydney Lake, Data Base Map, 52 L/NE
Map 5106	Northern Ontario Engineering Geology Terrain Study, Umfreville Lake, Data Base Map 52 L/SE
Map 5109	Northern Ontario Engineering Geology Terrain Study, Perrault Lake, Data Base Map, 52 K/SW
Map 2524	Geology of the Monument Bay Area, District of Kenora
Map 2528	Precambrian Geology, Melgund Lake Area, McAree Township, District of Kenora
Map 2529	Precambrian Geology, Melgund Lake Area, MacFie and Avery Townships, District of Kenora
Open File Reports	
OFR 5703	Geology of Lavai and Hartman Townships, District of Kenora
OFR 5707	Geology of the Monument Bay Area, Lake of the Woods, District of Kenora
OFR 5710	Geology of the Chisholm Island Area, Lake of the Woods, District of Kenora
OFR 5713	The Geological Setting and Distribution of Gold in the Cameron–Rowan Lakes Area, District of Kenora
OFR 5723	Geology, Gold Mineralization and Property Visits in the Area Investigated by the Dryden–Ignace Economic Geologist, 1984–1987, District of Kenora
Preliminary Maps	
P. 3109 (revised)	Precambrian Geology of Hartman Township, District of Kenora
P. 3143	Precambrian Geology, Falcon Island Area (Northern Part), District of Kenora
P. 3144	Precambrian Geology, Falcon Island Area (Southern Part), District of Kenora
Miscellaneous Papers	
MP 142	Report of Activities 1988, Resident Geologists
MP 146	Summary of Field Work and Other Activities 1989
OGS Final Reports	
Report 265	Precambrian Geology, Monument Bay Area, District of Kenora
Report 268	Precambrian Geology, Melgund Lake Area, District of Kenora
Geological Data Inventory Folios	
GDIF 454	Reynar Lake Area (52 L/6 NE)
GDIF 466	Wild Potato Lake (52 C/9 NW)
GDIF 467	Factor Lake Area (52 C/9 NE)
GDIF 468	Hepburn Lake Area (52 C/16 SE)
GDIF 469	Bennett Lake Area (52 C/16 SW)
GDIF 476	Treelined Lake Area (52 L/8 SW)
GDIF 477	Paterson Lake Area (52 L/7 SE)
GDIF 487	Stop Lake Area (52 L/1 NW)
GDIF 488	Snook Lake Area (52 L/2 NE)

Bachelor's Theses

C. Kimmerly did a petrographic study of rocks exposed on the east end of Chisholm Island in the Whitefish Bay area (Brock University, St. Catharines).

R. McEachern studied an Archean paleoregolith near Mine Centre (Lakehead University, Thunder Bay).

Master's Theses

T. Warman continued a study of the geochemistry, sedimentology and history of sedimentation of the red varved clays at Dryden (University of Manitoba, Winnipeg).

Doctoral Theses

A.F. Bajc continued a study of the glacial and glaciolacustrine history of the Fort Frances–Rainy River area (University of Waterloo, Waterloo).

F.W. Breaks concluded a study of the origin and evolution of granitic rocks and rare element pegmatites in the Dryden area (Carleton University, Ottawa).

S. Schaefer concluded a comparative study of the Ash Rock, Steeprock Mine area, and the ultramafic tuff in the Rice Bay dome (University of Minnesota, Duluth, Minnesota).

Other Research

P. Silver of the Carnegie Institute of Washington, D.C., in conjunction with the University of Wisconsin and the Ontario Geological Survey, conducted a teleseismic survey designed to measure crustal thicknesses and deep structures related to the structural nature of subprovincial boundaries.

SELECTED PUBLICATIONS RECEIVED, 1989

Breaks, F.W. 1989. Origin and evolution of peraluminous granite and rare element pegmatites in the Dryden area, Superior Province of northwestern Ontario; unpublished PhD thesis, Carleton University, Ottawa, 594p.

Charbonneau, H.E. 1988. Amphibolitization of K-rich andesites, Monument Bay area, Lake of the Woods; unpublished BSc thesis, University of Western Ontario, London, 83p.

Devaney, J.R. and Williams, H.R. 1989. Evolution of an Archean subprovince boundary: a sedimentological and structural study of part of the Wabigoon–Quetico boundary in northern Ontario; Canadian Journal of Earth Sciences, v.26, no.5, p.1013-1026.

Hornbrook, E.H. and Friske, P.W. 1989a. National geochemical reconnaissance lake sediment and water data, northwestern Ontario (parts of 52D and 52E); Geological Survey of Canada, Open File 1957.

——1989b. National geochemical reconnaissance lake sediment and water data, northwestern Ontario (52F); Geological Survey of Canada, Open File 1958.

Kormos, S. 1988. The Wilson gold deposit, Gull Island, Lake of the Woods, western Ontario; unpublished BSc thesis, Queen's University, Kingston, 56p.

Melling, D.R., Blackburn, C.E., Watkinson, D.H. and Parker, J.R. 1988. Geological setting of gold, western Wabigoon Subprovince, Canadian Shield: exploration targets in mixed volcanic successions; Canadian Journal of Earth Sciences, v.25, no.12, p.2075-2088.

Minning, G.V. 1988. Quaternary geology, Lake of the Woods region, northwestern Ontario, progress report for year 2, Blue Lake–Rowan Lake area; Geological Survey of Canada, Open File Report 1968, 40p.

——1989. Quaternary geology, Lake of the Woods region, northwestern Ontario, progress report for year 3, Rat Portage Bay–Northwest Angle areas; Geological Survey of Canada, Open File Report 2080, 47p.

Parker, J.R., Blackburn, C.E. and Davis, D.W. 1989. Constraints on timing and placement of gold mineralization in the Wabigoon Subprovince near Dryden, Ontario: evidence for synvolcanic through late tectonic emplacement; *in* Geological Association of Canada–Mineralogical Association of Canada, Program with Abstracts, v.14, p.A92.

Percival, J.A. 1989. A regional perspective of the Quetico metasedimentary belt, Superior Province, Canada; Canadian Journal of Earth Sciences, v.26, no.4, p.677-693.

Peterman, Z.E. and Day, W. 1989. Early Proterozoic activity on Archean faults in the western Superior Province—evidence from pseudotachylite; Geology, v.17, p.1089-1092.

Powell, W. 1988. Geology and mineralization of the Gold Mountain occurrence, Western Peninsula, Lake of the Woods, Ontario; unpublished BSc thesis, University of Toronto, Toronto, 99p.

Schaefer, S.J. 1989. A comparison of two Archean ultramafic pyroclastic rock units, northwestern Ontario; *in* 35th Institute on Lake Superior Geology, v.35, pt.1, Abstracts, p.77.

Shanks, W.S. 1985. A structural analysis of the Cedar Lake dome, northwestern Ontario; unpublished MSc thesis, University of Toronto, Toronto, 67p.

Stern, R.A., Hanson, G.N. and Shirey, S.B. 1989. Petrogenesis of mantle-derived, LILE-enriched Archean monzodiorites and trachyandesites (sanukitoids) in southwestern Superior Province; Canadian Journal of Earth Sciences, v.26, no.9, p.1688-1712.

REFERENCES

Ayer, J.A. and Buck, S. 1989. Geology of the Chisholm Island area, Lake of the Woods, District of Kenora; Ontario Geological Survey, Open File Report 5710, 177p.

Ayer, J.A., Gil, K.M. and McCurdy, M. 1985. Precambrian geology of the Bigstone Bay area, northern part, Kenora District; Ontario Geological Survey, Preliminary Map P.2830, scale 1:15 840.

Ayer, J.A., MacFie, R.I. and Buck, S. 1988. Precambrian geology of the Chisholm Island area, Lake of the Woods, District of Kenora; Ontario Geological Survey, Preliminary Map P.3121, scale 1:15 840.

Bajc, A.F. 1988. Gold grains in rotasonic drill core and surface samples (1987–1988) Fort Frances–Rainy River area, District of Rainy River; Ontario Geological Survey, Preliminary Map P.3140, scale 1:100 000.

Berger, B. 1988. Geology of the Manitou Stretch area, District of Kenora; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.145-152.

——In Prep. Precambrian geology of the Manitou Stretch area, District of Kenora; Ontario Geological Survey, Report.

Blackburn, C.E. 1976. Geology of the Lower Manitou–Uphill lakes area, District of Kenora; Ontario Division of Mines, Geological Report 142, 81p.

——1981. Kenora–Fort Frances, Kenora and Rainy River districts; Ontario Geological Survey, Map 2443, scale 1:253 440.

——1982. Geology of the Manitou Lakes area, District of Kenora (stratigraphy and petrochemistry); Ontario Geological Survey, Report 223, 61p.

Blackburn, C.E., Bond, W.D., Breaks, F.W., Davis, D.W., Edwards, G.R., Poulsen, K.H., Trowell, N.F. and Wood, J. 1985. Evolution of Archean volcanic-sedimentary sequences of the western Wabigoon Subprovince and its margins: a review; *in* Evolution of Archean Supracrustal Sequences, Geological Association of Canada, Special Paper 28, p.89-116.

Blackburn, C.E., Hailstone, M.R., Parker, J.R. and Storey, C.C. 1988. Kenora Resident Geologist's area – 1987; *in* Report of Activities 1987, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 138, p.3-40.

——1989. Kenora Resident Geologist's District – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.3-46.

Bow, J.A. 1898. Mines of northwestern Ontario; Ontario Bureau of Mines, Annual Report, 1898, v.7, pt.1, p.35-84.

——1900. Mines of northwestern Ontario; Ontario Bureau of Mines, Annual Report, 1900, v.9, p.35-88.

Brown, B.A. 1984. The role of granite diapirism in the deformational history of Archean greenstones of the central Lake of the Woods area, northwestern Ontario; unpublished PhD thesis, University of Manitoba, 176p.

Carter, W.E.H. 1904. Mines of western Ontario; Ontario Bureau of Mines, Annual Report, 1904, v.13, pt.1, p.58-87.

Coleman, A.P. 1898. Fourth report on the west Ontario gold region; Ontario Bureau of Mines, Annual Report, 1898, v.7, pt.2, p.111.

Coste, E. 1885. Report of the Gold Mines of the Lake of the Woods; Geological Survey of Canada, Report of Progress 1882–1884, pt.K, 22p.

Cowan, W.R. 1987. Quaternary geology, Lake of the Woods region, northwestern Ontario, progress report for year 1, Wabigoon–Gold Rock areas; Geological Survey of Canada, Open File Report 1697, 62p.

Davies, J.C. and Smith, P.M. 1988. The geological setting of gold occurrences in the Lake of the Woods area; Ontario Geological Survey, Open File Report 5695, 381p.

Delisle, P.C. and Perrault, M. 1989. Gold studies in the Dryden area, districts of Kenora and Rainy River; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.46-53.

Easton, R.M. and Johns, G.W. 1986. Volcanology and mineral exploration: the application of physical volcanology and facies studies; *in* Volcanology and Mineral Deposits, Ontario Geological Survey, Miscellaneous Paper 129, p.2-40.

Hodgson, C.J. 1989. Patterns of mineralization; *in* Mineralization and Shear Zones, Geological Association of Canada, Short Course Notes, v.6, p.51-88.

Hornbrook, E.H.W. and Friske, P.W.B. 1989. National geochemical reconnaissance lake sediment and water data, northwestern Ontario (parts of 52D and 52E); Geological Survey of Canada, Open File 1957.

Johns, G.W. 1987. Geology of the Long Bay–Lobstick Bay area, District of Kenora; Ontario Geological Survey, Open File Report 5626, 222p.

Johns, G.W. and Richey, S. 1982. Precambrian geology of the MacQuarrie Township area, Kenora District; Ontario Geological Survey, Preliminary Map P.2498, scale 1:15 840.

Kormos, S. 1988. The Wilson gold deposit, Gull Island, Lake of the Woods, western Ontario; unpublished BSc thesis, Queen's University, Kingston, 56p.

Minning, G.V. 1988. Quaternary geology, Lake of the Woods region, northwestern Ontario, progress report for year 2, Blue Lake–Rowan Lake areas; Geological Survey of Canada, Open File Report 1968, 40p.

——1989. Quaternary geology, Lake of the Woods region, northwestern Ontario, progress report for year 3, Rat Portage Bay–Northwest Angle areas; Geological Survey of Canada, Open File Report 2080, 47p.

Moorhouse, W.W. 1941. Geology of the Eagle Lake area; Ontario Department of Mines, Annual Report, 1939, v.48, pt.4, p.1-31.

Ontario Geological Survey 1980a. Airborne electromagnetic and total intensity magnetic survey, Manitou–Stormy lakes area, District of Kenora; Ontario Geological Survey, Map 80458, scale 1:20000.

——1980b. Airborne electromagnetic and total intensity magnetic survey, Manitou–Stormy lakes area, District of Kenora; Ontario Geological Survey, Map 80459A, scale 1:20000.

Parker, J.R. and Perrault, M. 1988. Gold studies in the Manitou Lake–Stormy Lake belt, districts of Kenora and Rainy River; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.126-131.

Pryslak, A.P. 1976. Geology of the Bruin Lake–Edison Lake area, District of Kenora; Ontario Geological Survey, Geoscience Report 130, 57p.

Ramsay, J.G. and Huber, M.I. 1987. The techniques of modern structural geology, volume 2: folds and fractures; Academic Press Inc. (London) Ltd., London, 700p.

Robert, R.G. 1987. Ore deposit models 11: Archean lode gold deposits; Geoscience Canada, v.14, no.1, p.37-52.

Satterly, J. 1943. Geology of the Dryden–Wabigoon area; Ontario Department of Mines, Annual Report, 1941, v.50, pt.2, p.1-67.

Sinclair, D.G., Tower, W.O., Bayne, A.S., Cooper, D.F., Weir, E.B. and Webster, A.R. 1938. Mines of Ontario in 1936; Ontario Department of Mines, Annual Report, 1937, v.46, pt.1, p.90-238.

Smith, P.M. and Stephenson, C.D. 1988. Geology of the Vista Lake area, districts of Rainy River and Kenora; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.138-144.

Stix, J. 1985. Volcanic facies and geochemistry of Archean lava flows and pyroclastic rocks near Kenora, Ontario, Canada; unpublished MSc thesis, University of Toronto, Toronto, 204p.

Stott, G. 1989. The tectonic assemblage map of Ontario; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.12-15.

Thomson, J.E. 1934. Geology of the Manitou–Stormy lakes area; Ontario Department of Mines, Annual Report, 1933, v.42, pt.4, 140p.

Thurston, P.C. and Chivers, K.M. In Press. Secular variation in greenstone sequence development emphasizing the Superior Province, Canada; Precambrian Research.

Trowell, N.F., Blackburn, C.E. and Edwards, G.R. 1980. Preliminary synthesis of the Savant Lake–Crow Lake metavolcanic-metasedimentary belt, northwestern Ontario, and its bearing upon mineral exploration; Ontario Geological Survey, Miscellaneous Paper 89, 30p.

Trowell, N.F., Logothetis, J., Caldwell, G.F. and Webb, J.R. 1987. Precambrian geology of the Gibi Lake area, District of Kenora; Ontario Geological Survey, Preliminary Map P.3076, scale 1:15 840.

3. Red Lake Resident Geologist's District—1989

B.T. Atkinson[1], J.R. Parker[2] and C.C. Storey[3]

[1]Resident Geologist, Red Lake Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Red Lake Resident Geologist's Office, Northwestern Region.

[3]Drill Core Library Geologist, Kenora Drill Core Library, Northwestern Region.

INTRODUCTION

Exploration has declined significantly from last year's record levels. This decline is apparent from the reduced number of claims staked and assessment work filed, as indicated in Table 3.1. The number of active exploration programs in the district is approximately half the number of programs carried out in 1988. However, the activities of several major companies in the Red Lake District have partially offset the disappearance of many junior companies from the exploration scene.

Inco Gold Company mounted a major surface and underground exploration effort on the Cochenour Willans Mine and Chevron Minerals Ltd. actively explored a number of Goldquest Exploration Inc. properties in the Red Lake greenstone belt.

In the Birch–Confederation lakes area, Noranda Exploration Company, Limited, acquired Bond Gold Canada Inc. and BP Canada Inc. properties, and joint ventured with Gold Fields Canadian Mining Ltd. on the Springpole Lake property. Teck Corporation participated in exploration of the Dixie Lake property with Mutual Resources Ltd.

Placer Dome Inc. continued exploration on a number of properties throughout the district.

Several of the northern greenstone belts received exploration attention for gold and base metals.

Figures 3.1a and 3.1b show the extent of mining and exploration activity in the Red Lake Resident Geologist's District. Table 3.2 outlines the exploration activity that has occurred during the year.

There were six Ontario Mineral Exploration Programs (OMEPs) in the district during the year. OMEP funding totalled $890625 on exploration expenditures of $4 million.

TABLE 3.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	1, 841	1, 548	11, 228	61, 422	39, 814	8, 510	132, 620
1988	2, 286	2, 368	10, 935	175, 600	215, 300	42, 666	457, 500
1987	4, 512	1, 708	11, 017	81, 854	138, 443	23, 440	261, 741
1986	3, 803	1, 598	10, 427	48, 325	127, 445	6, 360	189, 633
1985	2, 673	2, 260	8, 212	42, 000	201, 052	16, 642	269, 262
1984	4, 344	1, 725	7, 799	32, 588	78, 538	12, 495	123, 664
1983	2, 407	1, 204	5, 180	18, 637	22, 035	3, 468	53, 207
1982	942	1, 884	3, 992	23, 967	79, 662	6, 787	118, 775
1981	1, 719	1, 249	4, 889	28, 771	66, 000	8, 182	107, 430
1980	2, 220	1, 115	4, 301	38, 482	30, 240	871	71, 975
1979	1, 068	1, 763	3, 221	21, 108	38, 380	3, 154	62, 949
1978	1, 207	1, 521	3, 916	25, 574	19, 496	2, 480	50, 997
1977	2, 324	2, 395	4, 261	12, 994	45, 080	620	59, 196
1976	2, 705	1, 382	4, 332	18, 680	23, 578	380	46, 544
1975	1, 368	2, 059	2, 957	29, 377	12, 714	960	44, 717
1974	1, 339	1, 829	3, 648	47, 362	5, 660	3, 040	57, 719
1973	1, 616	3, 157	4, 009	60, 027	20, 474	NIL	83, 019
1972	2, 219	5, 284	5, 588	34, 261	14, 858	5, 216	56, 173
1971	1, 541	4, 922	8, 486	73, 019	50, 920	2, 243	127, 556
1970	3, 971	7, 194	11, 759	73, 886	329, 065	17, 606	427, 527
1969	10, 999	933	14, 772	49, 212	66, 032	1, 320	119, 039

TABLE 3.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	BHP-UTAH MINES LTD.	GEOLOGICAL, GEOPHYSICAL, GEOCHEMICAL SURVEYS; 123 km LINE CUTTING: FAIRLIE AND TODD TWPS.
2	BIRON BAY RESOURCES LTD.	GEOPHYSICAL SURVEY: EAST BAY, BATEMAN TWP.
3	BLACK CLIFF MINES LTD./ CYPRUS GOLD (CANADA) LTD.	GROUND GEOPHYSICAL SURVEY; DIAMOND DRILLING (19)-3091.6 m: LAIRD LAKE PROPERTY, KILLALA TWP.
4	CAMPBELL RED LAKE MINE (PLACER DOME INC.)	DIAMOND DRILLING (13)-3475 m: LASSIE RED LAKE PROPERTY, BALMER TWP.
5	CANADIAN PATRICIA EXPLORATION LTD.	DIAMOND DRILLING (10)-1656 m: NARROW LAKE PROPERTY, SKINNER TWP.
6	CANHORN MINING CORPORATION/ UNITED REEF PETROLEUMS LTD.	GROUND GEOPHYSICAL SURVEY; 65 km LINE CUTTING: AIKEN-RUSSETT PROPERTY, BAIRD TWP.
7	CHAMPION GOLD RESOURCES INC.	GROUND GEOPHYSICAL SURVEYS; 48 km LINE CUTTING: WESLEYAN LAKE MAP SHEET.
8	CHARLARMAR RESOURCES INC.	POWER STRIPPING: BALMER TWP.
9	CHEVRON MINERALS LTD.	POWER STRIPPING, SAMPLING, BULK SAMPLING (REDCON PROPERTY), GEOLOGICAL MAPPING, DIAMOND DRILLING (22)-7800 m: REDCON AND DUSCHENE PROPERTIES, BATEMAN TWP.; ABINO PROPERTY, BALMER TWP.; ROWAN PROPERTY, TODD TWP.; MARBOY PROPERTY, DOME TWP. POWER STRIPPING: CHARLENE PROJECT, HEYSON TWP.
10	DESMEULES, G.	GEOPHYSICAL SURVEYS; POWER STRIPPING: PAKWASH PROPERTY, DIXIE LAKE MAP SHEET.
11	FALCONBRIDGE LIMITED	DIAMOND DRILLING (6)-672.4 m: BIRCH LAKE AND HODGSON OPTION, SHABUMENI LAKE MAP SHEET.
12	FLINT ROCK MINES LTD.	DIAMOND DRILLING: SHABU LAKE AND SHABUMENI LAKE MAP SHEETS.
13	GOLDEN ARROW RESOURCES INC.	GEOPHYSICAL SURVEYS: BALMER TWP.
14	GOLD FIELDS CANADIAN MINING, LTD.	STRIPPING; DIAMOND DRILLING (7)-2217.7 m: MINK LAKE PROPERTY, CASUMMIT LAKE MAP SHEET. DIAMOND DRILLING: CASUMMIT CREEK AND SPRINGPOLE PROPERTIES, CASUMMIT LAKE MAP SHEET.
15	GOLDBRAE DEVELOPMENTS LTD.	GEOLOGICAL, GROUND GEOPHYSICAL SURVEYS, 168 km LINE CUTTING: CARRICONA PROPERTY, HEYSON TWP.
16	HERBERT, L./BOBINSKI, M.	AIRBORNE GEOPHYSICAL SURVEY; POWER STRIPPING: HEYSON TWP. AIRBORNE GEOPHYSICAL SURVEY: BATEMAN TWP.
17	HUSTON, C. D.	GEOPHYSICAL SURVEYS, LINE CUTTING: DIXIE LAKE MAP SHEET.
18	INCO GOLD INC.	GEOLOGICAL SURVEYS; DIAMOND DRILLING (SURFACE) 5181.4 m AND DIAMOND DRILLING (UNDERGROUND) 19201.5 m; POWER STRIPPING; SAMPLING, DEWATERING OF NO. 1 SHAFT TO 2350-FOOT LEVEL: COCHENOUR WILLANS MINE, DOME TWP.
19	JAMIE FRONTIER RESOURCES INC./ PEZGOLD RESOURCES CORPORATION	DIAMOND DRILLING (39)-3962.2 m: MOUNT JAMIE MINE, TODD TWP.
20	LAVERTY RED LAKE RESOURCES INC.	GEOCHEMICAL SURVEY: THRALL PROPERTY, HEYSON TWP.
21	MACIEJEWSKI, A.	STRIPPING, TRENCHING, SAMPLING: MULCAHY TWP. GROUND GEOPHYSICAL SURVEY; TRENCHING; STRIPPING: BALL TWP.
22	MCFINLEY RED LAKE MINES LTD.	CARE AND MAINTENANCE: MCFINLEY MINE, BATEMAN TWP.
23	NORAMCO EXPLORATIONS INC.	DIAMOND DRILLING: BONANZA PROPERTY, DOME TWP. DIAMOND DRILLING (4)-431 m: DEAN CREEK PROPERTY, BALL TWP. GEOLOGICAL SURVEY; DIAMOND DRILLING (4)-261.3 m: SETTING NET LAKE MAP SHEET. SAMPLING: NORTHWIND LAKE AND SETTING NET LAKE MAP SHEETS.
24	NORANDA EXPLORATION COMPANY, LTD.	GROUND GEOPHYSICAL SURVEYS: KARAS LAKE AND GERRY LAKE MAP SHEETS. GEOLOGICAL, GROUND GEOPHYSICAL SURVEYS; BENEFICIATION STUDIES: MITCHELL TWP. GEOLOGICAL, GEOCHEMICAL SURVEYS; POWER STRIPPING; TRENCHING; BENEFICIATION STUDIES: CASUMMIT LAKE AND KEIGAT LAKE MAP SHEETS. GEOLOGICAL, GEOCHEMICAL, GROUND GEOPHYSICAL SURVEYS; BENEFICIATION STUDIES; PROSPECTING: SLATE LAKE MAP SHEET. GEOCHEMICAL SURVEY; BENEFICIATION STUDIES; PROSPECTING: SHABUMENI LAKE MAP SHEET. GEOLOGICAL, GEOCHEMICAL SURVEYS; BENEFICIATION STUDIES; SAMPLING; PROSPECTING: DENT TWP. GEOLOGICAL, GEOCHEMICAL SURVEYS; DIAMOND DRILLING (2)-225 m: PARVUS PROPERTY, BAIRD TWP. GEOLOGICAL, GEOCHEMICAL, AIRBORNE AND GROUND GEOPHYSICAL SURVEYS; PROSPECTING: STULL LAKE MAP SHEET. GEOLOGICAL SURVEY; PROSPECTING: FAULKENHAM LAKE MAP SHEET. GEOCHEMICAL SURVEY; PROSPECTING: BRUCE LAKE MAP SHEET.
25	PELANGIO LARDER MINES LIMITED	AIRBORNE AND GROUND GEOPHYSICAL SURVEYS; LINE CUTTING: HEWITT LAKE MAP SHEET.
26	PETERSON, C. W./SPINELLI, J.	MANUAL WORK; POWER STRIPPING: BYSHE AND HEYSON TWPS.

TABLE 3.2. CONTINUED.

Number on Figure	Individual or Company	Activity
27	PLACER DOME INC.	GEOLOGICAL, GEOCHEMICAL, GROUND GEOPHYSICAL SURVEYS; DIAMOND DRILLING (23)-3972 m; 73 km LINE CUTTING: KEIGAT LAKE MAP SHEET. DIAMOND DRILLING (17)-2683 m: CORLESS TWP. DIAMOND DRILLING (2)-304 m: DENT TWP. GEOLOGICAL, GEOCHEMICAL, AND GROUND GEOPHYSICAL SURVEYS; 120 km LINE CUTTING: MCINNES LAKE MAP SHEET. GEOLOGICAL, GEOCHEMICAL, AND GROUND GEOPHYSICAL SURVEYS; DIAMOND DRILLING (4)-597 m; 55 km LINE CUTTING: FLY LAKE-TRIPPIER PROPERTY, MITCHELL TWP. DIAMOND DRILLING (7)-1001 m: ANGELA LAKE PROPERTY, CASUMMIT LAKE MAP SHEET. GEOLOGICAL, GEOCHEMICAL SURVEYS; DIAMOND DRILLING (6)-1014 m; 45 km LINE CUTTING: WEST RED LAKE PROPERTY, BALL TWP.
28	RED LAKE BUFFALO RESOURCES LTD.	GEOLOGICAL, AIRBORNE GEOPHYSICAL SURVEYS; POWER STRIPPING; PROSPECTING; RE-LOGGING OF CORE: MADSEN MINE PROPERTY, BAIRD TWP. AIRBORNE GEOPHYSICAL SURVEY; POWER STRIPPING; SAMPLING; GEOLOGICAL COMPILATION: STARRATT-OLSEN MINE PROPERTY, BAIRD TWP. AIRBORNE GEOPHYSICAL SURVEYS; SAMPLING: RED LAKE BUFFALO MINE PROPERTY, HEYSON TWP.
29	RIVARD, O.	DIAMOND DRILLING; TRENCHING: HEATH PROPERTY, TODD TWP.
30	SHERRITT GORDON LTD.	GEOPHYSICAL SURVEYS; DIAMOND DRILLING (12)-1805 m; SAMPLING: DORION ISLAND PROPERTY, DOME TWP.
31	SILVERSIDE RESOURCES INC.	GROUND GEOPHYSICAL SURVEY; DIAMOND DRILLING (3)-186.2 m; LINE CUTTING; SAMPLING: ROUILLARD OCCURRENCE, DENT TWP.
32	TECK CORPORATION/MUTUAL RESOURCES LTD.	GEOLOGICAL MAPPING; GROUND GEOPHYSICAL SURVEYS; DIAMOND DRILLING (27)-4090 m; 210 km LINE CUTTING: DIXIE LAKE MAP SHEET.
33	TWIN GOLD MINES LIMITED/AGASSIZ RESOURCES LTD.	GEOLOGICAL, GROUND GEOPHYSICAL SURVEYS; DIAMOND DRILLING (45)-4971.3 m; 21 km LINE CUTTING: LINGMAN LAKE MAP SHEET.
34	WALKER, A. J.	AIRBORNE GEOPHYSICAL SURVEY: KILLALA AND BAIRD TWPS.
35	WESTMIN RESOURCES LTD.	GEOCHEMICAL SURVEY; DIAMOND DRILLING (6)-400 m; SAMPLING: ELLARD OCCURRENCE AND WYNNE BAY OCCURRENCE, STULL LAKE AND RICHARDSON ARM OF STULL LAKE MAP SHEETS.

MINING ACTIVITY

Gold continued to be the only commodity produced in the district. Campbell Red Lake Mine (Placer Dome Inc.) and the Arthur W. White Mine (Dickenson Mines Ltd.) were the two producers of the precious metal. Production was up, over last year, at both mines. Year end production figures were unavailable at the time of writing, but are expected to exceed 1988 production of 239102 ounces gold from the Campbell Mine and 70259 ounces gold from the Arthur W. White Mine.

Placer Dome Inc.–Campbell Red Lake Mine

Projections for 1989 gold production at the Campbell Red Lake Mine are 262000 ounces of gold from 420000 tons of ore milled. Currently the mine head grade is 0.652 ounce gold per ton and the milling rate is 1170 tons of ore per day. This is a slight increase over last year's milling rate. Mill recovery is 95 percent. Forecast expenditures on the mine and mill are $11.7 million.

Development work for the year consists of 11400 feet of drifting and 4600 feet of raising. Diamond drilling totals of 60000 feet include 40000 feet of ore definition drilling and 20000 feet of exploration drilling.

The work force at the mine site includes 284 in the mine department, 49 in the mill, 120 in the plant and 35 in administration, for a total employment complement of 488.

Proven and probable ore reserves at the mine as of December 1989 are 6.2 million tons grading 0.634 ounce gold per ton for a total of 3930800 ounces of contained gold. All main ore zones contributed to production through the year.

Campbell obtained 17000 tons of waste rock from the McKenzie Gold Eagle Mine, a past producer, for use on its tailings dam. The waste rock was transported across Bruce Channel by ice road and was used to expand Campbell's tailings pond capacity. The company also set up a pilot plant to test bio-oxidation treatment of ore.

S. Reid is the General Manager of the mine (R. Church, Campbell Red Lake Mine, personal communication, 1989).

Dickenson Mines Ltd.–Arthur W. White Mine

Through a takeover share purchase, Goldcorp Investments Ltd. acquired a 65 percent equity interest in Dickenson Mines Ltd. (The Northern Miner, June 26, 1989).

At the Arthur W. White Mine, this year's gold production is expected to be 78000 ounces. The mine is operating with a head grade of 0.31 ounce gold per ton and the milling rate is 780 tons of ore per day. The mill recovery stands at 89 percent, of which 84 percent is free milling gold and 5 percent is recovered from sulphide concentrate. Construction of a gravity circuit is under way in the mill circuit and is scheduled for completion in early 1990. The gravity circuit will completely replace the mercury amalgamation circuit. Installation of a new backfill circuit at the mine has allowed more solids tailings to be returned to underground mined areas, resulting in a reduction of tailings discharge.

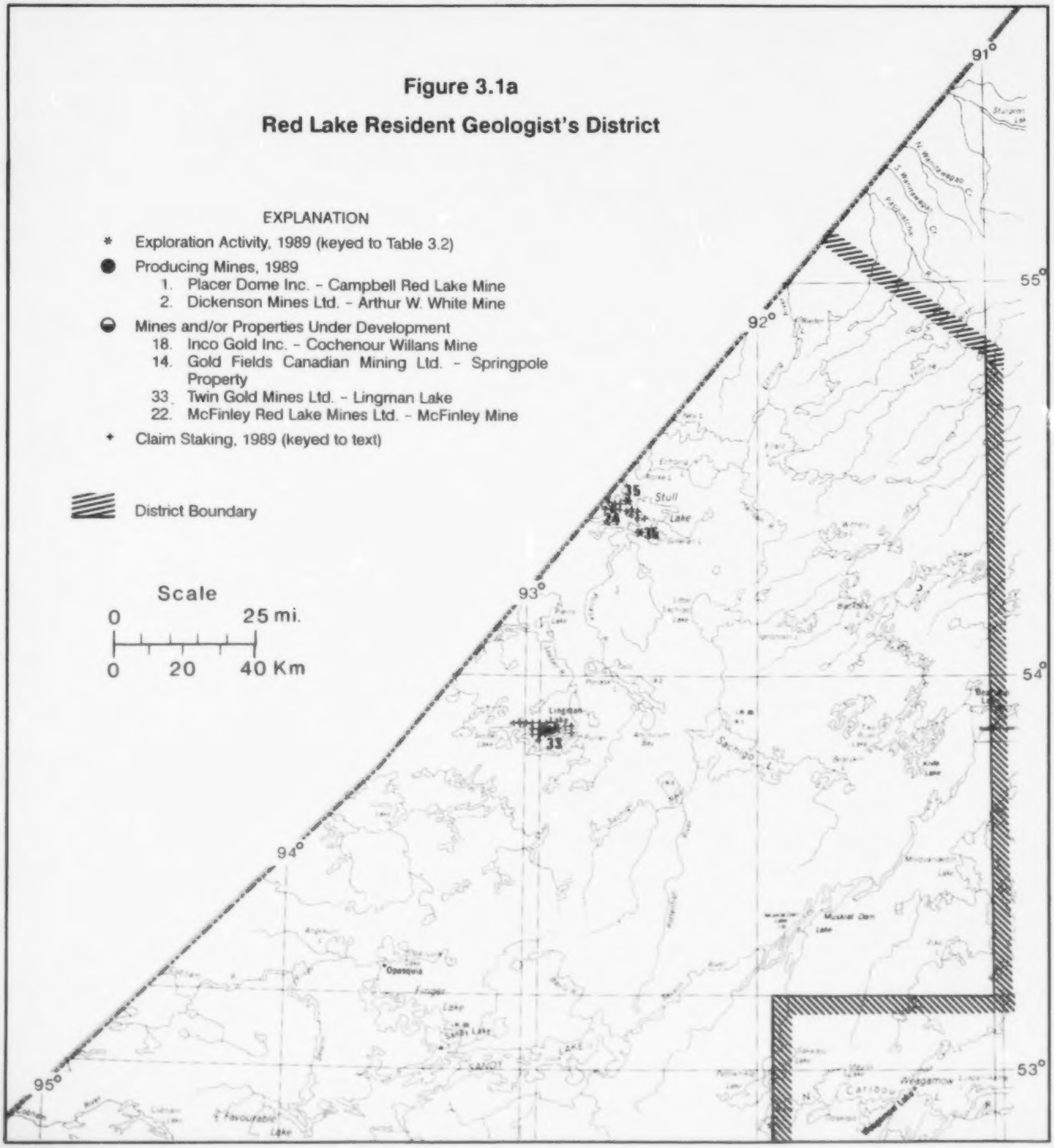


Figure 3.1a

Red Lake Resident Geologist's District

EXPLANATION
* Exploration Activity, 1989 (keyed to Table 3.2)
● Producing Mines, 1989
1. Placer Dome Inc. - Campbell Red Lake Mine
2. Dickenson Mines Ltd. - Arthur W. White Mine
◒ Mines and/or Properties Under Development
18. Inco Gold Inc. - Cochenour Willans Mine
14. Gold Fields Canadian Mining Ltd. - Springpole Property
33. Twin Gold Mines Ltd. - Lingman Lake
22. McFinley Red Lake Mines Ltd. - McFinley Mine
+ Claim Staking, 1989 (keyed to text)
▨ District Boundary
Scale
0
25 mi.
0
20
40 Km
91°
92°
93°
94°
95°
55°
54°
53°
Stull
Lake
35
24
36
Lingman Lake
33
Sachigo L.
Muskrat Dam Lake
Opasquia
Finger Lake
Sandy Lake
SANDY
LAKE
Favourable Lake
Caribou
Weagamow L.
N

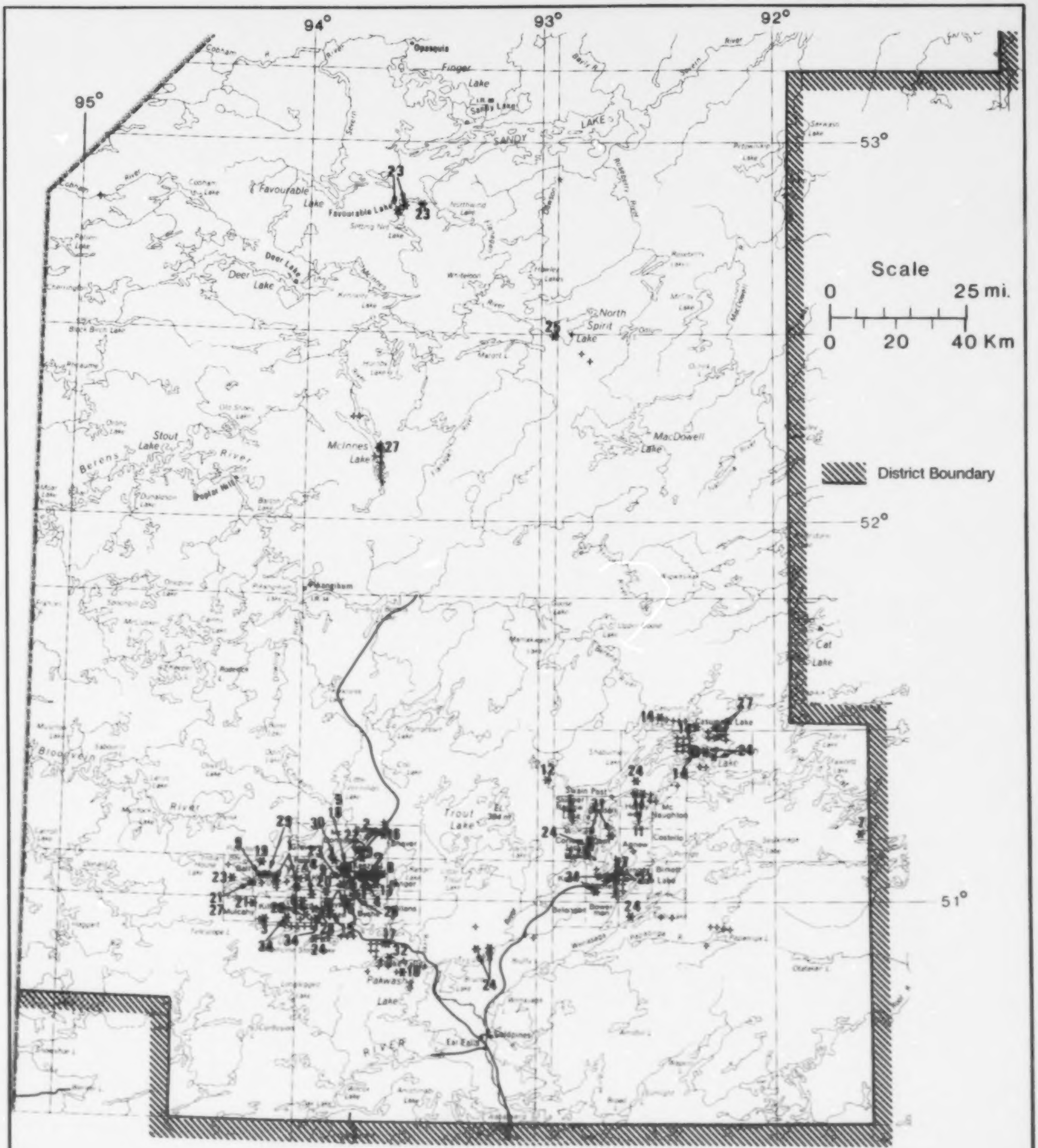

94°
93°
92°
95°
53°
52°
51°
Scale
0
25 mi.
0
20
40 Km
District Boundary
Finger Lake
Sandy Lake
Favourable Lake
Deer Lake
North Spirit Lake
Stout Lake
Berens River
McInnes Lake
MacDowell Lake
Cat Lake
Trout Lake
Pakwash Lake
Ear Falls
River

Figure 3.1b

Red Lake Resident Geologist's District

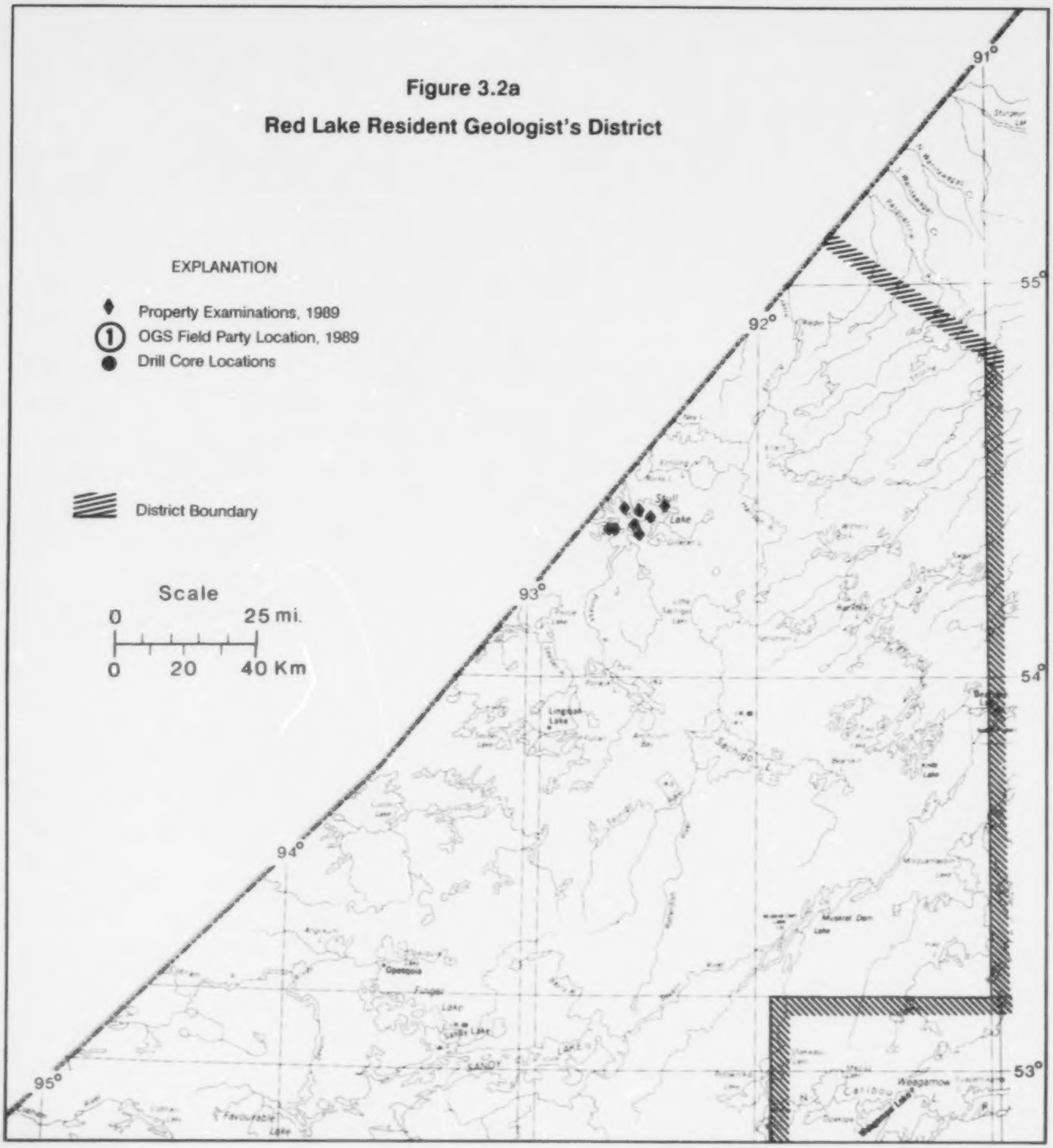


Figure 3.2a
Red Lake Resident Geologist's District

EXPLANATION
♦ Property Examinations, 1989
① OGS Field Party Location, 1989
● Drill Core Locations
▨ District Boundary
Scale
0
25 mi.
0
20
40 Km
91°
92°
93°
94°
95°
55°
54°
53°
Skull Lake
Lingman Lake
Sachigo L.
Opasquia
Finger Lake
Sandy Lake
SANDY
LAKE
Muskrat Dam Lake
Caribou
Weagamow
Favourable Lake

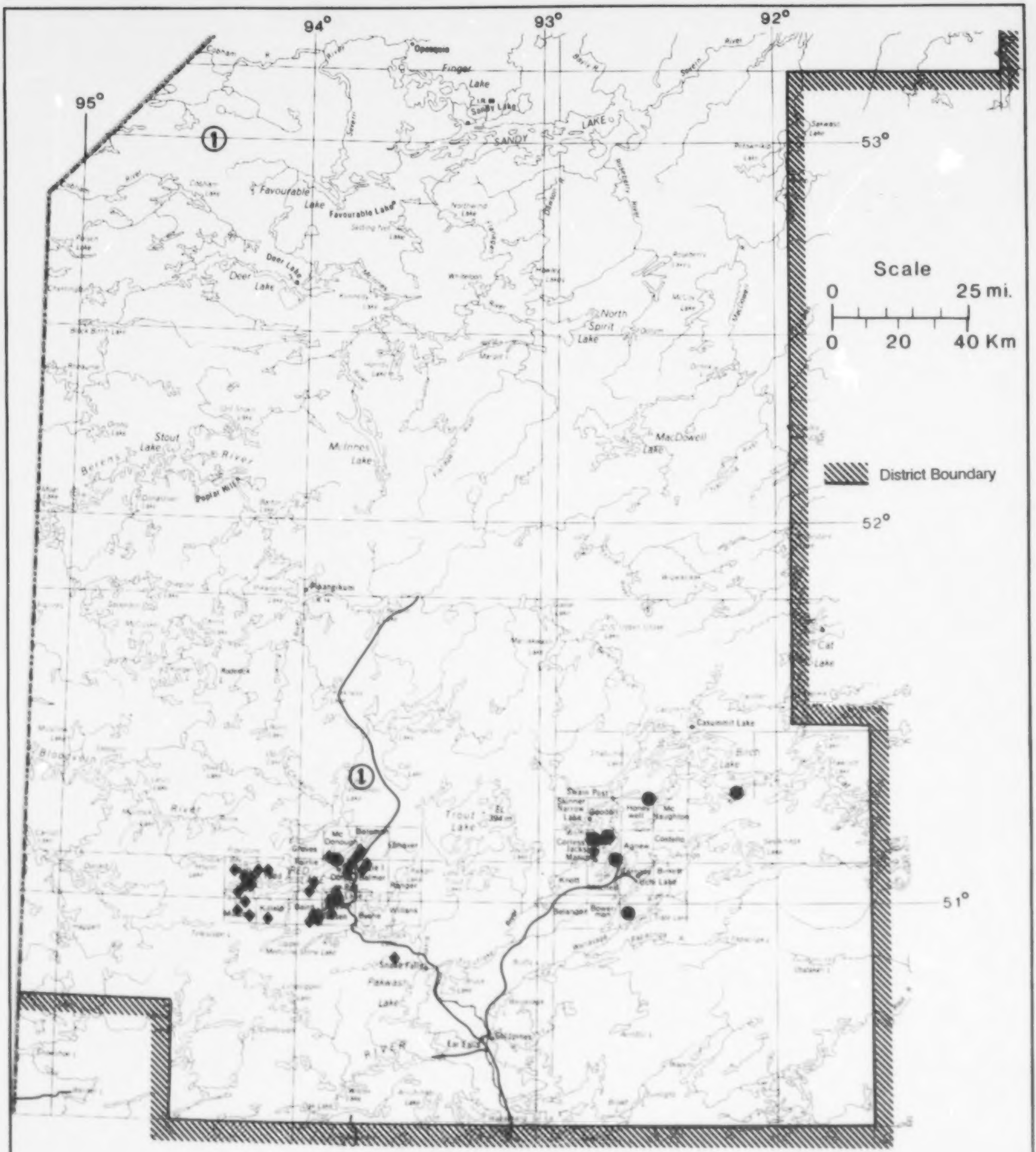

94°
93°
92°
95°
53°
52°
51°
①
Finger Lake
Sandy Lake
SANDY LAKE
Favourable Lake
Deer Lake
North Spirit Lake
Stout Lake
Berens River
Poplar Hill
McInnes Lake
MacDowell Lake
Pikangikum
Cat Lake
Casummit Lake
Birch Lake
Trout Lake
Bloodvein River
Swain Post
Honeywell
McNaughton
Costello
Agnew
Mc Donough
Balmer
Ranger
Bowerman
Slate Falls
Pakwash Lake
RIVER
Ear Falls
Scale
0
25 mi.
0
20
40 Km
District Boundary

Figure 3.2b

Red Lake Resident Geologist's District

Development work including drifting, raising and crosscutting will total 11000 feet for the year, and diamond drilling, most of which is directed to ore definition, will total 82000 feet.

The number of employees at the mine totals 360, of which, 198 work in the mine department, 41 in the mill, 77 in the plant and 44 in administration.

Ore reserves at the mine as of December 1989 include 1397201 tons grading 0.34 ounce gold per ton in the proven category, and 1868795 tons grading 0.30 ounce gold per ton in the probable category. Total reserves are 3265996 tons grading 0.32 ounce gold per ton for a gold inventory of 1045119 ounces.

Mine developments include the opening up of drill-indicated ore in the PML zone on the 27th level. An additional 140000 tons of ore have been outlined between the 15th and 16th levels in the "East South C" ore zone.

B. Bried is Mine Manager (J. Rogers, R. Knopp, Arthur W. White Mine, personal communications, 1989).

ADVANCED EXPLORATION AND DEVELOPMENT

Inco Gold Inc.-Cochenour Willans Mine

Inco Gold Inc. continued an extensive exploration program on the Cochenour Willans Mine in Dome Township. This past-producing mine yielded 1244279 ounces of gold from 1939 to 1971, at an average grade of 0.538 ounce gold per ton.

Inco Exploration and Technical Services Inc. is operator of the exploration program at the mine on behalf of Inco Gold Inc. At the mine site, the No. 1 shaft was dewatered to the 2350-foot level and 63000 feet of underground drilling was completed. Drilling tested several areas for gold mineralization, these were: 1) the southern chert zone on the 1800-foot level; 2) the main sedimentary facies between the 1675- and 2200-foot levels; and 3) north-trending structures and structures trending 320° on various levels throughout the mine. The north-trending structures consist of carbonate and fuchsite in silicified shears hosting pyrite and arsenopyrite mineralization. Approximately 3500 underground channel samples were analyzed.

In addition to the underground program, 17000 feet of surface drilling was completed. Surface drilling probed the northeast extension, where the geology includes silicified zones in mafic metavolcanics. Power stripping, sampling and geological mapping were completed for the surface exploration program. Expenditures to date by Inco total $5.1 million (T. Lloyd, Inco Exploration and Technical Services Inc., personal communication, 1989).

Gold Fields Canadian Mining Ltd.-Springpole Property

Gold Fields Canadian Mining Ltd. has been actively exploring the Springpole property in the Birch Lake area since 1985. To date, exploration expenditures have totalled approximately $8 million. The company has drilled 118 holes totalling 125816 feet on the property, delineating 10 zones of gold mineralization (Corptech Industries Inc., Vancouver Stockwatch, May 30, 1989).

The most significant mineralization occurs in the southeast-trending Portage zone, which is located on the portage between Springpole Lake and Birch Lake. This zone has a strike length of 3800 feet and a width of up to 500 feet.

Published drill results include the following intersections from the Portage zone.

Intersection (feet)	Assay (ounce Au per ton)
91.9	0.286*
34.0	0.196*
67.0	0.110*
156.0	0.067*
47.0	0.47**

* *Corptech Industries Inc. –Vancouver Stockwatch, May 30, 1989.*
** *Akiko-Lori Gold Resources Ltd. –Vancouver Stockwatch, October 30, 1989.*

A joint venture agreement between Akiko-Lori, Gold Fields and Noranda has been announced for the Springpole property. Terms of the agreement allow Akiko-Lori and Noranda to earn a 51 percent interest in the property by spending $10 million on the property by March 1994. Noranda is the designated operator for the project (Akiko-Lori Gold Resources Ltd., Vancouver Stockwatch, October 30, 1989).

Twin Gold Mines Ltd.-Lingman Lake

As operator of this property, Agassiz Resources Ltd. transferred equipment and fuel to Lingman Lake from Pierce Lake, where it had been cached the previous year due to poor weather and winter road conditions. The company continued surface exploration of the property. Work included drilling 45 holes totalling 16311 feet. Three composite samples were shipped to Lakefield Laboratories for metallurgical testing (D. McPhee, Twin Gold Mines Ltd., personal communication, 1989).

McFinley Red Lake Mines Ltd.

Underground workings continue to be dewatered at McFinley Mine, in Bateman Township, but the property was inactive through the year.

EXPLORATION ACTIVITY

RED LAKE GREENSTONE BELT

The Red Lake greenstone belt was again the dominant area for exploration activity. A total of 21 companies and individuals carried out 27 projects in search of gold mineralization.

BHP-Utah Mines Ltd.

BHP-Utah Mines Ltd. carried out geological mapping, geophysical surveys and humus sampling on their Wolf Bay and Soltermann properties in Todd and Fairlie townships.

Black Cliff Mines Ltd.

Black Cliff Mines Ltd. conducted geophysical surveys and diamond drilling of 19 holes totalling 3091.6 m on the Laird Lake property in Killala Township. A series of old trenches excavated by local prospectors on the east end of Laird Lake expose ferruginous chemical metasediments in mafic to intermediate metavolcanic host rocks. Grab samples from the trenches returned low values of gold mineralization.

The best drill intersections were 0.205 ounce gold per ton over 1.5 m and 0.245 ounce gold per ton over 1.3 m in two separate drill holes by Black Cliff Mines Ltd.

Campbell Red Lake Mine (Placer Dome Inc.)

The Campbell Red Lake Mine carried out an exploration drill program on the neighbouring Lassie Red Lake Gold Mines Ltd. property comprising 13 holes totalling 11400 feet (R. Church, Campbell Red Lake Mine, personal communication, 1989).

Canhorn Mining Corporation–United Reef Petroleums Ltd.

Canhorn Mining Corporation–United Reef Petroleums Ltd. completed geophysical surveys on claims west of the Aiken–Russett property in Baird Township.

Chevron Minerals Ltd.

Chevron Minerals Ltd. joint ventured with Goldquest Exploration Inc. to explore the latter company's properties in the Red Lake greenstone belt. The option agreement terms include the expenditure of $8 million by Chevron over five years to earn a 50 percent interest in Goldquest's properties (The Northern Miner, March 13, 1989). In this, the first year of the agreement, Chevron expenditures totalled approximately $1 million. Work included extensive power stripping and drilling on four properties totalling 7800 m in 22 holes. Drilling was carried out on the Rowan property in Todd Township, the Marboy property in Dome Township, the Abino property in Balmer Township and the Duschene property in Bateman Township. Stripping was completed on the Redcon property in Balmer Township and on the Duschene and Rowan properties. A small bulk sample was taken from a 3 m wide iron carbonate vein on the Redcon property that had been previously drilled by Goldquest. Processing of the bulk sample at Lakefield Laboratories yielded low gold values. (K. Shannon, Chevron Minerals Ltd., personal communication, 1989.)

Goldbrae Developments Ltd.

Goldbrae Developments Ltd. completed mapping and geophysical surveys over the Carricona property in Heyson Township.

Jamie Frontier Resources Inc.

Pezgold Resources Corporation drilled 39 holes totalling 12 000 feet at the Mount Jamie Mine, in Todd Township. The drill program did not increase the mineral reserve of 72500 tons grading 0.406 ounce gold per ton (The Northern Miner, April 24, 1989).

Laverty Red Lake Resources Inc.

Laverty Red Lake Resources Inc. completed humus sampling on the Thrall property in Heyson Township.

Noramco Explorations Ltd.

Noramco Explorations Ltd. completed diamond drilling from the ice on Red Lake, on the Bonanza property, Dome Township, in the vicinity of Whitehorse Island. The 1988–89 drill program consisted of 34 holes totalling 4785 m. This year's drill program was a follow-up of the preceding year's drilling that outlined a mineralized zone 3 to 5 m wide, 150 m long and 125 m deep. The grades of the mineralized zones range from 2.1 to 12.7 grams per tonne (g/t) (George Cross News Letter, No. 103, May 30, 1989). The company also did additional drilling on the Dean Creek property in Ball Township.

Noranda Exploration Company, Limited

Noranda Exploration Company, Limited, conducted ground geophysical surveys and diamond drilled two holes totalling 225 m on the Parvus property in Baird Township.

Placer Dome Inc.

Placer Dome Inc. acquired an option on the Shane Resources Ltd. West Red Lake property in Ball Township (Vancouver Stockwatch, February, 1989). Placer Dome Inc. conducted geological mapping and geochemical surveys, and drilled six holes totalling 1014 m in the vicinity of underground workings on the property.

Red Lake Buffalo Resources Ltd.

Red Lake Buffalo Resources Ltd. currently hold the Red Lake Buffalo Mine in Heyson Township, and the Madsen and Starratt–Olsen mines in Baird Township, all of which are past producers. An airborne geophysical survey was flown over all three properties early this year. Red Lake Buffalo completed geological mapping, prospecting, sampling and core relogging on the Madsen Mine property. Power stripping concentrated on the McVeigh zone and the No. 8 footwall zone on the southeast side of Russett Lake on the Madsen Mine property. On the Starratt–Olsen Mine property, power stripping and sampling was completed on the DeVillier's zone south of Flat Lake. Minor sampling was also done on the Red Lake Buffalo property in the vicinity of Snib Lake. (J. Hamilton, Red Lake Buffalo Resources Ltd., personal communication, 1989.)

O. Rivard

O. Rivard ran a small drill program on his Heath property in Todd Township.

Sherritt Gordon Limited

Sherritt Gordon Limited diamond-drilled 12 holes totalling 1805 m on the Dorion Island property in Dome Township. Only low values of gold mineralization were reported.

DIXIE LAKE AREA

Mutual Resources Ltd.-Teck Corporation

Substantial interest has resulted from Mutual Resources Ltd.'s work on the Dixie Lake property which the company optioned from several local prospectors. Last year's drilling encountered encouraging gold mineralization that was followed up with additional drilling by Teck Corporation. Numerous speculative claims have since been staked in the area (refer to Property Examinations—Dixie Lake Occurrence section).

BIRCH LAKE AREA

Canadian Patricia Exploration Ltd.

Canadian Patricia Exploration Ltd. diamond drilled their Narrow Lake, Skinner Township property late in the year. The drill program consisted of ten holes totalling 5433 feet (S. Waldie, Canadian Patricia Exploration Ltd., personal communication, 1989).

Falconbridge Ltd.

Falconbridge Ltd. drilled four holes on their Grace Lake property and two holes on a second claim group south of Swain Lake.

Flint Rock Mines Ltd.

Flint Rock Mines Ltd. completed approximately 2000 feet of diamond drilling on their Shabu Lake property (A. Lewis, Flint Rock Mines Ltd., personal communication, 1989).

Gold Fields Canadian Mining Ltd.

Gold Fields Canadian Mining Ltd. carried out additional drilling on their Springpole property, on their Mink Lake claims and their Casummit Creek property (refer to Property Examinations—Springpole Property section).

Noranda Exploration Company, Limited

Noranda Exploration Company, Limited, completed geophysical and geological surveys as well as lithogeochemical sampling on a number of claim groups in the Birch-Confederation lakes area. Power stripping was completed on their Springpole claims southeast of Gold Fields Springpole property.

Placer Dome Inc.

Placer Dome Inc. drilled the Fly Lake-Trippier property in Mitchell Township, and the Angela Lake, Corless Township and Birch Lake properties. Drilling on the Fly Lake-Trippier property tested an auriferous copper-zinc occurrence in felsic metavolcanics, as well as an auriferous quartz-tourmaline vein hosted by a quartz-feldspar porphyry.

Silverside Resources Inc.

Silverside Resources Inc. completed geophysical surveys and drilled three holes totalling 186.2 m on their 98-claim group in Dent Township. Drilling was centred on the Rouillard occurrence. The best drill intersection assayed 0.118 ounce gold per ton over 0.7 feet (B. Gajaria, Silverside Resources Inc., personal communication, 1989).

WESLEYAN LAKE AREA

Champion Gold Resources Inc.

Champion Gold Resources Inc. was the only active company in this part of the central Uchi greenstone belt, which extends westward into the Red Lake District from the Sioux Lookout District. Champion completed airborne and ground geophysical surveys on their claim group which encompasses a known gold occurrence.

NORTHERN GREENSTONE BELTS

McInnes Lake

Placer Dome Inc. conducted geological mapping, sampling and geophysical surveys on their claims in the McInnes Lake greenstone belt.

Favourable Lake

Noramco Explorations Inc. carried out geological surveys, sampling and diamond drilling on the Berens River East property. Reserves at the Berens River Mine have been recalculated to 192096 tons grading 0.255 ounce gold per ton, and 5.11 ounces silver per ton (George Cross News Letter, No. 47, March 8, 1989).

North Spirit Lake

Pelangio-Larder Mines Ltd. completed geophysical surveys on their claims in the North Spirit Lake greenstone belt.

Lingman Lake

Agassiz Resources Ltd. continued work on the Lingman Lake property (refer to Advanced Exploration and Development section).

Stull Lake

Westmin Resources Limited drilled three holes on the Ellard occurrence and three holes on the Wynne Bay occurrence (*see* section on Reconnaissance of the Stull Lake Greenstone Belt). The drill was mobilized via a winter road from Manitoba.

Also in the Stull Lake area, Noranda Exploration Company, Lt[illegible] completed airborne and ground geophysical surveys as well as geological and geochemical surveys on their claims.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

J.R. Parker was appointed Staff Geologist and took up duties in the Red Lake office in February. B.T. Atkinson and L. Kosloski continued as Resident Geologist and Secretary, respectively. R. Thompson served as summer field assistant on the Experience '89 program.

During the year, office staff made underground site visits to both producing mines and two advanced development projects in the district. A total of four underground mines were visited outside the District. These included the Dona Lake, Golden Patricia and Lyon Lake mines in the Patricia Mining Division, and the Cameron Lake gold property in the Kenora Mining Division.

Parker instructed an introductory prospecting course to 20 students in Red Lake in the later part of the year.

Atkinson completed field mapping of Heyson Township, at a scale of 1:10560.

Work on the Birch–Confederation lakes gold occurrence compilation continued through the year.

A total of 36 mineral occurrences and exploration projects were visited by staff, and five field trips of the local geology were given to exploration personnel. One week was spent examining geology and mineral occurrences in Stull Lake. Results of that work are summarized below.

ACKNOWLEDGMENTS

L. Kosloski drafted several of the figures and typed the manuscript. K.G. Fenwick reviewed the text.

Information of past work included in this report is from the Assessment Files, Resident Geologist's office, Ministry of Northern Development and Mines, Red Lake, unless otherwise stated.

RECONNAISSANCE OF THE STULL LAKE GREENSTONE BELT

LOCATION AND ACCESS

The Stull Lake greenstone belt is located 400 km north of Red Lake and extends across the Ontario–Manitoba provincial border. Stull Lake is 100 km east of Gods Lake, Manitoba, and 265 km southeast of Ilford, Manitoba. Access is via float-equipped aircraft. A winter road from Island Lake, Manitoba, connects the area to the Manitoba highway network.

PREVIOUS WORK AND EXPLORATION ACTIVITIES

The Stull Lake area was originally mapped by Satterly (1938) in 1936 at a scale of 1:126720. Downie (1938a, 1938b) produced maps covering the entire Stull Lake and Little Stull Lake areas at a scale of 1:253440 for the Department of Mines and Resources.

Operation Lingman Lake (Riley and Davies 1967; Bennett and Riley 1969) included reconnaissance mapping of the Stull Lake greenstone belt at a scale of 1:126720. Most recently, the Stull Lake belt was briefly examined as part of a re-evaluation of northern greenstone belts (Thurston et al. 1987).

Prospecting and staking in the Stull Lake area was under way as early as 1935 (Satterly 1938).

Phelps Dodge Corporation of Canada Ltd. carried out geophysical surveys and diamond drilling of the Rapson Bay–Stull Lake occurrence on the west side of Rapson Bay in 1960. Reported mineralization in drill logs includes pyrite, pyrrhotite, sphalerite and chalcopyrite.

Rio Tinto Canadian Exploration Limited drilled nine holes under the Ellard occurrence in 1961 on auriferous quartz veins.

Serem Ltd. carried out geophysical surveys and diamond drilling on a number of claim groups on the lake in 1970 and 1971.

Gulf Minerals Canada Ltd. completed reconnaissance exploration of the belt in 1978. No record of this work was filed for assessment credits.

In 1979, Noranda Exploration Company, Limited, carried out limited diamond drilling on five properties on Stull Lake and Gilleran Lake for base metals.

Westmin Resources Ltd. staked several large groups of claims on both sides of the Ontario–Manitoba provincial border. An airborne survey was flown in 1987, with follow-up ground surveys and diamond drilling of the Ellard occurrence and Wynne Bay South occurrence in 1989.

Noranda acquired a group of claims in the belt in 1988 with follow-up work including prospecting, airborne and ground geophysical surveys, and geochemical and geological surveys in 1989 (W. Reid, Noranda Exploration Company, Limited, personal communication, 1989).

QUATERNARY GEOLOGY

Due to the proximity of Stull Lake to the Sachigo interlobate moraine (Satterly 1937), glacial striae measurements were taken at most observation points. General ice directions implied by striae indicate a north to south ice flow. Observed striae orientations vary from 138° to 202°.

Complex striae orientations on "Ellard Island" (local name) trend 202°. The bedrock on the island is capped with a 3 m thickness of varved silts and clays.

Most shoreline outcrops reflect the action of glacial smoothing and polishing while several islands in the central part of the lake show *roche moutonnée* development.

Varved silts and clays are widespread around the lake, as are sand and boulder tills. Most island and mainland shorelines are boulder armoured. Sand beaches are very rare. Thick deposits of lacustrine sediments including silt, clay, mud and gyttja underlie much of Richardson Arm and Rapson Bay.

GENERAL GEOLOGY

The Stull Lake greenstone belt occurs in the Sachigo Subprovince of the Superior structural province. All major lithologies are Archean age. North-trending diabase dikes transecting the belt are considered part of the Molson dike swarm of Proterozoic age (Osmani, in preparation). The belt is elongate with a west-northwest trend, attaining a maximum width of 15 km.

The south margin of the greenstone belt is a transitional contact with tonalitic to granodioritic gneiss. Migmatite and agmatite screens of tonalite gneiss contain numerous pegmatitic dikes of potassium feldspar, albite, quartz and biotite. Muscovite-bearing dikes are rare. The south greenstone-granitoid contact position, as indicated by Downie (1938a), was confirmed by the authors.

The metavolcanic-metasedimentary assemblages within the belt have been subdivided into two lithostratigraphic groups by Downie (1938a, 1938b). The major lithostratigraphic subdivisions are the older Hayes River Group and the Oxford Group.

Hayes River Group

The Hayes River Group (Downie 1938a) consists of a predominantly mafic metavolcanic assemblage of pillowed to massive flows. Lesser amounts of intermediate to felsic metavolcanics and derived metasediments are component parts of the Hayes River Group.

Rocks of the Hayes River Group outcrop on the south side of Stull Lake. Good exposures occur along Richardson Arm, and along the south part of Stull Lake to the contact with the southern, felsic gneissic terrain. The Hayes River Group also occurs on the north side of Stull Lake and underlies most of Rapson Bay.

Oxford Group

The Oxford Group (Downie 1938a) consists dominantly of clastic metasediments with lesser amounts of intermediate to felsic metavolcanics. Metasediments include clast-supported boulder conglomerate with granitoid, wacke and arkosic clasts and minor iron formation clasts. Felsic metavolcanics consist of dacitic and rhyolitic flows, and thin pyroclastic units within a volcaniclastic conglomerate sequence.

Rocks of the Oxford Group crop out on the west shore of Stull Lake north of Richardson Arm and on the east side of the lake north of Wynne Bay.

ALTERATION

Iron carbonate alteration is widespread in the north part of Stull Lake. Pervasive alteration affects mafic metavolcanics on "Ellard Island" (local name), and shoreline outcrops in this vicinity. Iron carbonate alteration was noted in pumiceous, felsic pyroclastic rocks and interbedded conglomeratic units on several reefs in the main body of the lake, 2 km south of Ellard Island (Figure 3.3).

The east side of Rapson Bay has been affected by pervasive carbonate (calcite) alteration of pumiceous to scoriaceous mafic metavolcanic flows and interbedded wacke metasediments.

In the northeast arm of Rapson Bay, a zone of intense epidotization-carbonatization pervades pillowed mafic metavolcanics. Whole rock analysis of a sample of altered, pillowed mafic flow from the Yvonne occurrence indicated CaO_2 and CO_2 enrichment and MgO, Na_2O, K_2O, TiO_2 and P_2O_5 depletion (Geoscience Laboratories, Ontario Geological Survey, Toronto).

STRUCTURE

The Stull Lake belt has been interpreted as an anticlinal structure (Satterly 1938), a synclinal structure (Bennett and Riley 1969) and a south-facing homoclinal sequence (Thurston et al. 1987). Although evidence for north-facing lithologies is lacking in the north half of Stull Lake, it has been documented on the Manitoba side of the belt, in the vicinity of Little Stull Lake (Corkery 1981a, 1981b).

Foliations across the belt trend northwest and dip southwest. Several foliation dip reversals were noted in the north part of Stull Lake and Rapson Bay.

Wynne Bay Deformation Zone

The Wynne Bay deformation zone (WBDZ) (Figure 3.3) trends northwest and is defined by the development of high strain markers including elongated conglomerate clasts, pronounced fabric, and boudinage and rotation of quartz veins. The extension of the WBDZ under the waters of Stull Lake is based on diamond drilling by Noranda Exploration Company, Limited, in 1979. The Stull Lake-Wunnummin Lake fault zone is a major crustal fault with an approximate length of 430 km (Osmani and Stott 1988). The Wynne Bay deformation zone may be a splay related to the Stull Lake-Wunnummin Lake fault where it transects the Stull Lake greenstone belt.

ECONOMIC GEOLOGY

Rare quartz-tourmaline veins up to 10 cm in width occur in the Wynne Bay deformation zone. Veins are subparallel to the regional fabric and contain rare amounts of pyrite and chalcopyrite.

A small rock island in the north part of Stull Lake exposes clast-supported felsic conglomerates in contact with mafic metavolcanics. Both rock types are intensely iron carbonate altered. A sample of pyritic mafic metavolcanics assayed 40 ppb Au and 190 ppm As (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

GOLD OCCURRENCES

Ellard Occurrence

The Ellard occurrence, also known as the Eagle Island or Ellard Island occurrence, is located on a small island at the north end of Stull Lake (Figure 3.3). The island is approximately 3.2 km due south of the entrance into

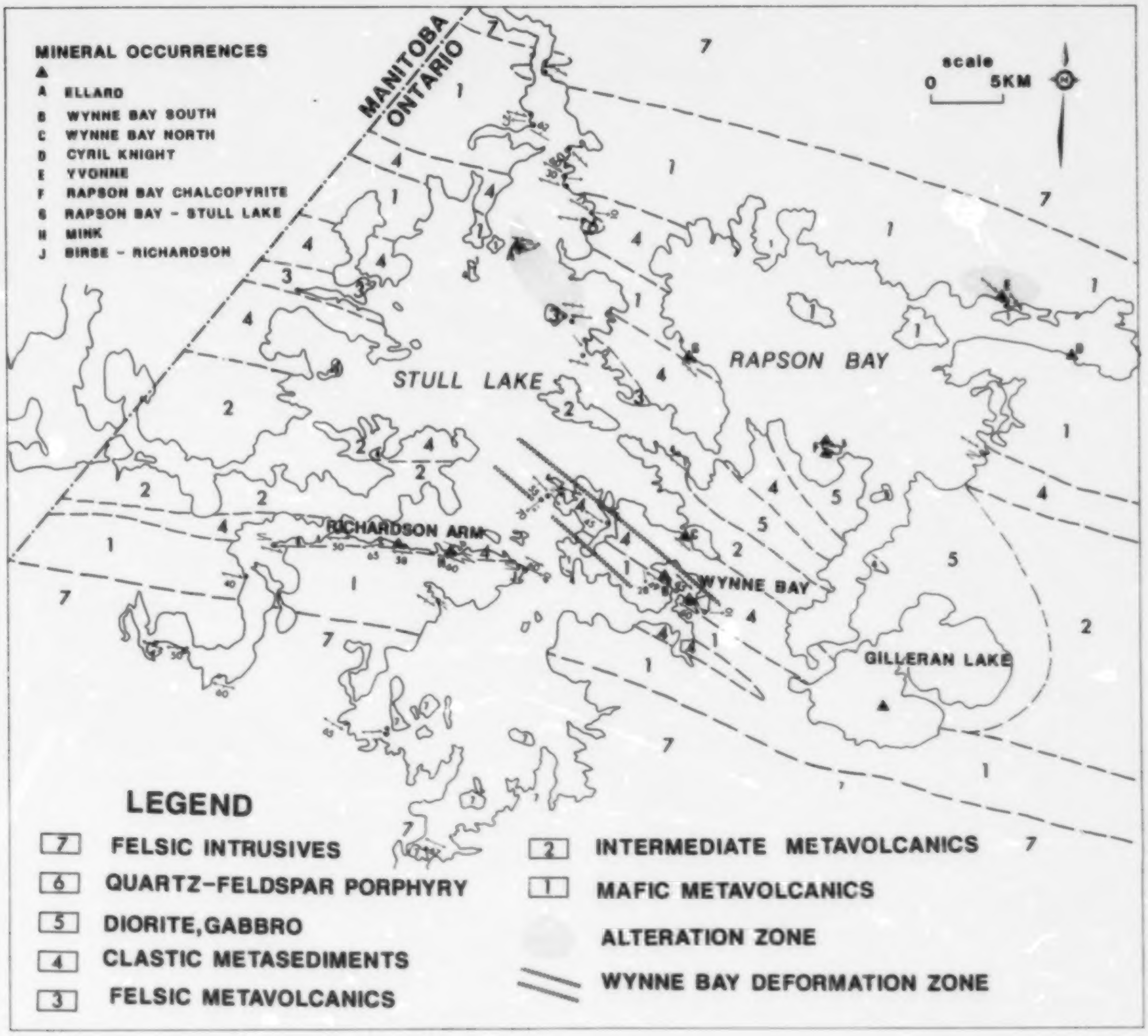

MINERAL OCCURRENCES
A ELLARD
B WYNNE BAY SOUTH
C WYNNE BAY NORTH
D CYRIL KNIGHT
E YVONNE
F RAPSON BAY CHALCOPYRITE
G RAPSON BAY - STULL LAKE
H MINK
J BIRSE - RICHARDSON
MANITOBA
ONTARIO
scale
0 5KM
STULL LAKE
RAPSON BAY
RICHARDSON ARM
WYNNE BAY
GILLERAN LAKE
LEGEND
7 FELSIC INTRUSIVES
6 QUARTZ-FELDSPAR PORPHYRY
5 DIORITE, GABBRO
4 CLASTIC METASEDIMENTS
3 FELSIC METAVOLCANICS
2 INTERMEDIATE METAVOLCANICS
1 MAFIC METAVOLCANICS
ALTERATION ZONE
WYNNE BAY DEFORMATION ZONE

Figure 3.3. General geology of the Stull Lake greenstone belt.

Stull River. The occurrence is presently encompassed by mining claim KRL 960105, and consists of a few small, shallow, test pits dug on well-exposed quartz veins near the lake shore.

The occurrence was discovered and staked by the K.G. Ellard Grubstake Syndicate in 1959. Two gold-bearing quartz veins were subsequently stripped, trenched and sampled.

Rio Tinto Canadian Exploration Limited optioned the property in 1960 and diamond-drilled nine holes totalling 2822.5 feet.

Westmin Resources Limited staked the Ellard occurrence in 1986 and conducted airborne magnetic and electromagnetic surveys over the property in 1987. Westmin mapped and sampled the occurrence in 1988 and completed three diamond-drill holes totalling 525 feet during 1989.

The Ellard occurrence is situated within metavolcanics and metasediments of the Hayes River Group (Downie 1938a). The rocks at the occurrence are comprised of thickly bedded, mafic pyroclastic rocks consisting of mafic tuff, feldspar-phyric crystal tuff, lapilli tuff and tuff breccia. The rocks are chloritic, intensely iron carbonatized, sericitized, and weather buff-orange-brown. Iron carbonatization is widespread throughout the host rocks.

Abundant, mineralized, quartz-carbonate veins and stringers occur within a number of subparallel, 0.9 to 1.5 m wide, shear zones. The shear zones trend between 110° and 130°, and are subparallel to bedding planes in the mafic pyroclastic rocks. Mineral lineations plunge steeply to the east. Wall rocks in the shear zones are intensely deformed and altered and contain up to 5 percent disseminated pyrite. Narrow, dark green, chloritic alteration halos up to 10 cm wide occur adjacent to some of the quartz veins. The veins are commonly boudinaged and drag folded into a penetrative cleavage trending 070°.

The quartz veins consist of vitreous white or grey quartz containing variable amounts of disseminated pyrite and minor galena. Other minerals such as arsenopyrite, pyrrhotite, chalcopyrite, sphalerite, tourmaline and visible gold are reported to occur in the quartz veins in drill core.

Two mineralized quartz veins have been exposed on the south shore of the island. The number one vein is situated at the extreme east end of the island. The number two vein is about 100 m west of the number one vein. Three grab samples taken from the number one vein, by the K.G. Ellard Grubstake Syndicate, assayed 2.65, 3.84, and 4.0 ounces gold per ton, respectively; a 30-inch channel sample across the vein assayed 0.84 ounce gold per ton. The K.G. Ellard Grubstake Syndicate also took two 3-foot channel samples across the number two vein, which assayed 2.0 ounces gold per ton and 0.98 ounce gold per ton, respectively.

Grab and chip samples taken from the number one vein by Westmin Resources Limited analyzed between 135 and 1620 ppb Au. Samples taken by Westmin from the number two vein analyzed between 95 and 600 ppb Au with two, 0.5 m chip samples assaying 10.6 g/t gold and 11.8 g/t gold.

A grab sample of quartz vein material taken from the occurrence by the Ontario Department of Mines, during the Operation Lingman Lake Project, assayed 1.86 ounces gold per ton and 2.36 ounces silver per ton (Bennett and Riley 1969).

A grab sample taken by the authors from the number one vein analyzed 1380 ppb Au; two grab samples taken from the number two vein analyzed 100 and 540 ppb Au. A strongly pyritized grab sample from the number two vein assayed 0.35 ounce gold per ton (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Diamond drilling conducted by Rio Tinto Limited and Westmin Limited, at the Ellard occurrence, intersected narrow mineralized sections with intense alteration and quartz-carbonate veining. Some of the best drill intersections encountered during Rio Tinto's drill program were 0.14 ounce gold per ton across 2.5 feet, 0.09 ounce gold per ton across 2 feet, and 0.05 ounce gold per ton across 3.7 feet. Silver values as high as 0.3 ounce silver per ton across 2.5 feet were also intersected.

The best intersection encountered during Westmin's drill program was 290 ppb Au and 1.12 ounces silver per ton across 1 m, with greater than 1 percent each of Zn and Pb.

Wynne Bay South Occurrence

The Wynne Bay South occurrence is located on the south shore of Wynne Bay, at the southeast corner of Stull Lake (Figure 3.3). The occurrence is presently encompassed by mining claims KRL 960115, KRL 960116 and KRL 966832, and is exposed by a number of small, shallow test pits on the immediate lake shore.

The occurrence was discovered and staked in 1935 by the Wynne Syndicate, who conducted stripping and trenching on the property. Ten diamond-drill holes totalling 1500 feet were also completed, with assay results ranging between trace and 0.04 ounce gold per ton (Satterly 1938).

A grab sample taken by Satterly (1938) from a quartz vein at the occurrence assayed 1.65 ounces gold per ton. Two grab samples taken from the occurrence by the Ontario Division of Mines, during the Operation Lingman Lake Project, assayed 0.02 and 0.08 ounce gold per ton with traces of copper and lead (Bennett and Riley 1969).

Westmin Resources Limited staked the occurrence in 1986 and conducted airborne magnetic and electromagnetic surveys over their claims in 1987. Westmin also completed three diamond-drill holes totalling 787.4 feet in 1989. The holes were targeted on the main mineralized zone, and intersected sections of quartz veining, alteration and sulphide mineralization including disseminated arsenopyrite. The highest gold value reported was 1830 ppb Au across 1 m.

The Wynne Bay South occurrence is situated within metasediments of the Oxford Group (Downie 1938a). The rocks at the occurrence consist of medium-grained, thickly bedded wackes interlayered with mafic tuff and pyritic shale. The metasediments are strongly sheared parallel to bedding at 140/75SW, with abundant small S-folds and mineral lineations plunging 10° to 30° southeast. A secondary cleavage trends 112°. The metasediments are intruded by a 1.8 to 3 m wide, fine-grained, felsic dike striking subparallel to bedding. The dike is well exposed and extends along the lake shore.

The majority of quartz veins at the occurrence are fracture and shear hosted, and occur within the felsic dike. The dike weathers buff brown and is intensely sericitized with weak carbonatization and variable biotitization and silicification. Quartz veins are widely spaced, 2.5 to 15 cm wide, and commonly contain up to 5 percent disseminated pyrite with minor pyrrhotite and chalcopyrite. Less than 2 percent disseminated pyrite and pyrrhotite occur in the host rocks adjacent to the quartz veins. A grab sample, taken by the authors, from one of the pyritic quartz veins, assayed 0.3 ounce gold per ton (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

A test pit, measuring 6 by 2 by 0.5 m deep, is situated approximately 1 km northwest of the main showing at the northwest end of Wynne Bay. The test pit is visible on the lake shore and has been sunk on gossan-stained, sheared, shaly metasedimentary rocks containing abundant disseminated pyrrhotite and pyrite. Quartz veining is parallel to the foliation and has been boudinaged. Foliation trends 128/49SW with mineral lineations plunging 28° south.

Wynne Bay North Occurrence

The Wynne Bay North occurrence is situated approximately 600 m north of Wynne Bay, on the south shore of a long southeast-trending arm of Stull Lake (Figure 3.3). The occurrence consists of a few shallow test pits on the immediate lake shore.

This occurrence was discovered and staked in 1935, by the Wynne Syndicate. Three holes drilled on the property by the Syndicate gave disappointing results (Satterly 1938). A grab sample taken from the occurrence by Satterly (1938) assayed 0.03 ounce gold per ton.

The Wynne Bay North occurrence is situated within metasediments of the Oxford Group (Downie 1938a). The rocks at the occurrence consist dominantly of fine-grained, grey-brown wackes interlayered with mafic tuff. The rocks are amphibolitized, sericitized, variably silicified and contain minor actinolite. Intense shearing is parallel to bedding planes in the metasediments and trends between 120° and 140°.

A shallow test pit has been sunk on a 0.6 m wide, semimassive, sulphide zone which has been exposed along a strike length of 5 m. Host rocks contain between 5 and 50 percent sulphides consisting dominantly of pyrite, pyrrhotite and minor chalcopyrite. Five grab samples collected by the authors from the sulphide zone analyzed: 200 ppb Au, 590 ppm Cu and 2 ppm Ag; 655 ppb Au, 565 ppm Cu, and 4 ppm Ag; 980 ppb Au, 750 ppm Cu, and 3 ppm Ag; 3520 ppb Au, 670 ppm Cu, and 5 ppm Ag; and 0.2 ounce per ton gold, 1.25 ounces silver per ton, and 344 ppm Cu (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Cyril Knight Occurrence

The Cyril Knight occurrence is located on the south shore of the northeast arm of Rapson Bay, Stull Lake (Figure 3.3). The exact location of this occurrence was recently determined, by the authors, from J. Satterly's field notes (J. Satterly, Resident Geologist's Files, Ministry of Northern Development and Mines, Red Lake). Current Mineral Deposit Inventory (MDI) files included this occurrence with the Rapson Bay–Stull Lake occurrence.

The Cyril Knight occurrence was discovered, staked and trenched by the Cyril Knight Prospecting Co. Ltd. in 1935 (Satterly 1938). Satterly (1938) observed very little sulphide mineralization at the occurrence, but did report that fine gold had been panned from grab samples taken from one of the quartz veins on the property.

The occurrence was not visited during the present study, but a geological description of the property is provided by Satterly (1938, p.31).

SULPHIDE OCCURRENCES

Yvonne Occurrence

The Yvonne occurrence is located on the north shore of the northeast arm of Rapson Bay, Stull Lake (Figure 3.3).

The occurrence consists of fine-grained, pillowed, mafic flows which weather grey-green to buff-brown and are pale apple-green on fresh surfaces. The mafic flows are intensely epidotized, very hard, and fracture conchoidally, however, petrographic examination and whole rock analyses (Geoscience Laboratories Section, Ontario Geological Survey, Toronto) of the mafic flows indicate the absence of secondary silicification. No sulphide mineralization was found at this occurrence during the present examination.

During 1979, Noranda Exploration Company, Limited, drilled one hole totalling 358 feet, to test a geophysical target near the occurrence. Drilling intersected altered intermediate to felsic pyroclastic rocks interlayered with graphitic shales and semimassive sulphides consisting of pyrite, pyrrhotite and chalcopyrite. Low anomalous values of Zn, Cu and Ag were reported in the drill logs.

Rapson Bay Chalcopyrite Occurrences

Two separate chalcopyrite occurrences are located on a small island near the entrance to the southeast arm of Rapson Bay, Stull Lake (Figure 3.3). The location of one of the occurrences is indicated on Map P.426 (Riley and Davies 1967) as a chalcopyrite showing on the south shore of the island. The location of the second occurrence is indicated on Map 46c (Satterly 1938) as a pyrite occurrence on the north shore of the island. Both occurrences are situated near the northern contact of a large mafic intrusion centred on Gilleran Lake, southeast of Rapson Bay.

Both occurrences consist of 10 to 20 cm wide, east-trending, fracture-hosted quartz veins in a coarse-grained, anorthositic gabbro. The quartz veins and adjacent wall rocks host disseminated chalcopyrite, bornite, malachite and azurite.

A grab sample, taken by the authors, from a quartz vein at the occurrence on the south shore of the island analyzed 250 ppb Au, 17 ppm Ag and 1.7 percent Cu. Two grab samples taken from quartz veins on the north shore of the island analyzed 510 ppb Au, 16 ppm Ag and 1.94 percent Cu, and 110 ppb Au, 2 ppm Ag and 2110 ppm Cu (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Bennett and Riley (1969) obtained a value of 0.24 percent Cu from a sample taken from a trench in mafic and ultramafic intrusive rocks at the southwest corner of Rapson Bay. However, the exact location of their sample site is unknown.

Rapson Bay–Stull Lake Occurrence

The Rapson Bay–Stull Lake occurrence is situated on the southwest shore of Rapson Bay, Stull Lake (Figure

3.3). The location of the occurrence is indicated as a pyrite, pyrrhotite, chalcopyrite, sphalerite showing on Map P.426 (Bennett and Riley 1969).

The occurrence was discovered during a diamond-drill program conducted by Phelps Dodge Corporation of Canada Ltd. in 1960. The company drilled three holes totalling 1058.5 feet to test a number of geophysical targets. Diamond-drill logs indicate the holes intersected mafic to felsic metavolcanics interlayered with metasediments. Zones of strong deformation hosting abundant quartz-carbonate veins, intense silicification, carbonatization, and disseminated pyrite, pyrrhotite, chalcopyrite and graphite mineralization were reported in the logs.

Lake shore outcrops, in the vicinity of the occurrence, consist dominantly of massive, mafic, metavolcanic flows. The rocks are foliated at 140/90 and host several widely spaced, 0.3 to 0.9 m wide, shear zones. The rocks are variably carbonatized, sericitized and biotitized with silicification and pyritization in some of the narrow shear zones.

Three grab samples, taken by the authors, from altered and pyritic mafic metavolcanics and quartz veins analyzed less than 2 ppb Au. A grab sample of intensely silicified and pyritic mafic metavolcanic rock analyzed 21 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Mink Occurrence

The Mink occurrence is located on the south shore of Richardson Arm at the southwest end of Stull Lake (Figure 3.3). The occurrence is indicated as a pyrite, sphalerite, chalcopyrite showing on Map P.426 (Riley and Davies 1967).

Mineralization occurs within metasediments consisting dominantly of wackes interlayered with more mafic metasediments. The wackes contain abundant quartz and sericite, while the mafic metasediments contain hornblende and garnet porphyroblasts in a biotitic matrix.

The rocks are strongly foliated at 120/60S and S-folded on a 1 to 2 m scale. Variable amounts of disseminated pyrite and pyrrhotite occur throughout the rocks. A few narrow, barren, quartz veins are hosted by the metasediments. Narrow seams of sphalerite and chalcopyrite, described by Satterly (1938), were not found by the authors.

Four grab samples from the metasediments and quartz veins, taken by the authors, assayed less than 0.01 ounce gold per ton (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

A pyrite occurrence located 1.2 km west of the Mink occurrence (Figure 3.3) was also examined by the authors. The location of this occurrence is indicated on Map P.426 (Riley and Davies 1967).

The geology is similar to the Mink occurrence, and grab samples taken from pyritic metasediments assayed less than 0.01 ounce gold per ton (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Birse-Richardson Property

The Birse-Richardson property consisted of a small group of claims staked in 1935, on the peninsula immediately south of Richardson Arm, Stull Lake (Figure 3.3). The area encompassed by the original claims consists of strongly deformed mafic metavolcanic flows interlayered with felsic metasediments, all of which are intruded by felsic and intermediate dikes. Barren quartz veins occur along the contacts of the dikes (Satterly 1938).

Satterly (1938) reported some stripping, trenching and diamond drilling on the claims in the late 1930s. The authors found no evidence of previous work, or significant mineralization in the area. One grab sample taken from a mafic pyroclastic rock analyzed less than 2 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

PROPERTY EXAMINATIONS

Figures 3.2a and 3.2b show the property visits and core collection sites in the Red Lake Resident Geologist's District.

GOLD OCCURRENCES AND PROSPECTS

Dixie Lake Occurrence

The Dixie Lake occurrence is located 24 km southeast of Red Lake. Access to the property is by a logging road that leads west from Highway 105, 25 km (by road) south of Red Lake.

The first discovery of the Dixie Lake occurrence is reported by R. Thompson in 1947. Thompson attributes the find to two trappers, H. Andeson and N. Andeson. Available claim records indicate the occurrence was first staked and prospected by J. Mitchell and others. Four zones of interest were identified by prospecting and these were referred to as the A, B, C and D zones. The D zone included the initial gold discovery on the south side of Dixie Creek, approximately 4 km downstream from Dixie Lake. Eight X-ray holes were drilled by A. Boyle in 1944 and an additional four holes were drilled the following year for Belgold Mines Limited; this drilling was restricted to the A zone. No records of drill logs are available for these holes.

Nine holes totalling 933 feet were drilled into the B zone in 1951 by Curie, Mahoney and McDougall. The highest reported assay was 0.12 ounce gold per ton over 2.3 feet.

Carravelle Mines Ltd. flew an airborne survey over the occurrence in 1969 and did follow-up drilling in the vicinity, but not on the occurrence.

In 1985, Golden Terrace Resources Corporation flew an airborne survey over a large block of claims that encompassed the occurrence. No follow-up work was completed by the company.

In 1988, 95 claims covering the occurrence were staked by local prospectors, G. Desmeules, M. Desmeules, W. McNerney and D.B. Smith, and optioned to Mutual Resources Ltd. The claims are presently held in escrow by National Trust Company for Mutual Resources Ltd.

Mutual Resources Ltd. diamond-drilled seven holes on the property, totalling 465 m. The best results from this drill program included a 19.4-foot section grading 0.107 ounce gold per ton including 5.6 feet grading 0.30 ounce gold per ton (Vancouver Stockwatch, August 15, 1989). The area of this drill intersection is now referred to as the 88-4 zone after the drill hole number that first tested the mineralized zone. The 88-4 zone drill collar is located approximately 300 m northeast of the original A zone or "Main showing".

In 1989, Teck Corporation acquired an option to earn a 50 percent interest in the Dixie Lake property (George Cross News Letter, No. 126, June 30, 1989). Teck drilled 27 holes on the property totalling 4090 m as a follow-up to Mutual's 1988 drilling and to test other geophysical targets. One hole, drilled in the vicinity of the 88-4 zone, intersected a mineralized zone 9.3 feet wide that assayed 0.455 ounce gold per ton (The Northern Miner, September 11, 1989). Follow-up drilling of the 88-4 zone encountered additional gold mineralization.

The Dixie Lake occurrence is located in the western Uchi Subprovince. General geology consists of large, ellipsoidal, felsic domal intrusions with narrow belts of greenstone wrapping around the intrusions (Breaks et al. 1974). The Dixie Lake occurrence is located 2 km east of the Longlegged Lake Dome within greenstone terrain (Figure 3.4).

Local geology of the occurrence includes mafic metavolcanic flows with intercalated chemical and clastic metasediments. The A zone, or Main showing, exposes a 55 m strike length of thinly banded, chert-magnetite iron formation, trending north. The iron formation is enclosed by massive garnetiferous mafic metavolcanics and crosscut by mafic dikes. Narrow pyrite-bearing quartz veins cut the iron formation. Overburden cover obscures much of the geology. Geophysical surveys suggest that stratigraphy trends abruptly eastward, just north of the A zone, implying that a significant fold exists at the occurrence.

Drilling by Teck Corporation has encountered gold mineralization associated with black, pyrrhotitic, silicified argillites, in contact with mafic metavolcanics.

Springpole Property

The Springpole Property is located approximately 115 km northeast of Red Lake in the Birch–Confederation lakes greenstone belt. The property is situated within a group of 33 contiguous, patented, mining claims centred on the portage between Springpole and Birch lakes, at the extreme north end of Springpole Lake.

Northern Aerial Minerals Exploration Company Limited conducted prospecting and staking in the vicinity of the Springpole property in 1928. T. Dunkin staked eight claims over the area in 1934, and conducted strip-

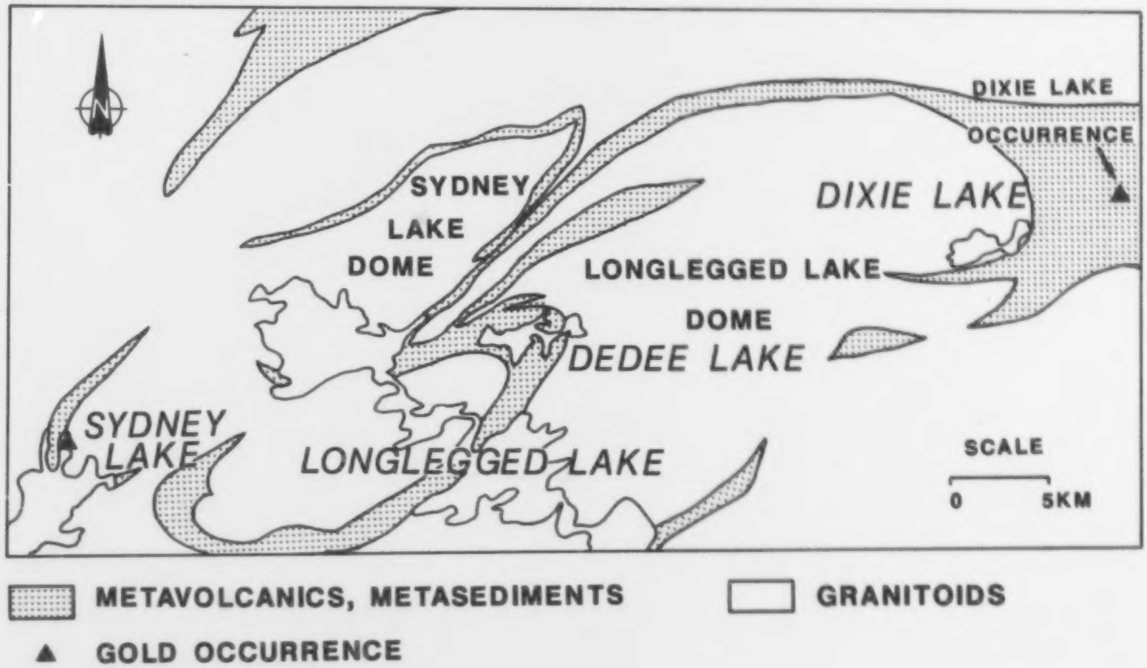


Figure 3.4. Geology of the Dixie Lake area.

ping and trenching on claim KRL 11229. A number of adjoining claims were staked during 1935. Harding (1936) noted that two west-northwest-trending parallel shear zones extended across the property, and hosted abundant quartz veins and disseminated sulphides. Gold values as high as 1 ounce gold per ton were reported from the shear zones (Harding 1936).

Windigokan Sturgeon Mining Syndicate acquired 24 claims encompassing the Springpole property in 1935. The company conducted extensive trenching, stripping and sampling, and diamond-drilled 10 holes, totalling 1500.9 feet. Drilling intersected silicified lenses within the shear zones, with some intersections assaying 1.82 ounces gold per ton across 3.5 feet, 0.17 ounce gold per ton across 15.25 feet and 0.2 ounce gold per ton across 11.75 feet. Fluorite mineralization in carbonate was indicated in drill core logs.

Springpole Gold Mines Limited acquired the Springpole property, consisting of 30 claims, in 1937. The company reported that two mineralized zones had been delineated by trenching, stripping and diamond drilling. The West, or Main zone, on claim KRL 11229, had been exposed for about 600 feet along strike. The East zone, located about 2200 feet east of the West zone, on claim KRL 11231, had been delineated by trenching over a strike length of 300 feet. Chip sampling across the East zone returned assays up to 0.23 ounce gold per ton across 20 feet.

R. Frahm conducted stripping and trenching on three claims, adjoining the south boundary of the patented mining claims of the Springpole property, during 1981.

In 1985, Gold Fields Canadian Mining Limited acquired the patented mining claims encompassing the Springpole property and a large block of enclosing claims. During the same year, the company conducted airborne and ground magnetic and electromagnetic (EM) surveys over the claims, as well as geological mapping of selected areas. During 1986 and 1987, the company conducted geochemical surveys, prospecting, geological mapping, stripping, sampling, and ground magnetic, very low frequency-electromagnetic (VLF-EM) and induced polarization (IP) surveys over the Springpole property. Gold Fields also completed another airborne magnetic and EM survey over their properties in 1987. The company completed extensive diamond drilling between 1985 and 1989. Some results of this drilling are summarized in the Advanced Exploration and Development section of this report.

The Springpole property (Figure 3.5) is underlain by a northwest-trending assemblage of mafic and intermediate metavolcanics, with metasediments consisting dominantly of polymictic conglomerates interlayered with argillite, greywacke and iron formation. The property is located along the northeast limb of an overturned synformal anticline, with a shallow plunge to the northwest (Harding 1936; Good et al. 1986; Good 1988).

Stratigraphy trends between 290° and 330° and dips between 55° and 70° to the northeast. A pervasive west-northwest-trending foliation parallels stratigraphy and dips 50° to 70° to the northeast. Mineral lineations trend 310° and 330° and plunge 10° to 40° to the west. The metavolcanic-metasedimentary assemblage is intruded by a large, irregular body of diorite, at the west end of the property. A subvolcanic feldspar-porphyry outcrops east of the diorite (Figure 3.5), and intrudes alkaline metavolcanic tuffs, potassium feldspar porphyry flows and pyroclastic breccias.

Recent research by Barron et al. (1989) indicated gold mineralization at the Springpole property is spatially associated with an alkaline volcanic complex, situated at an unconformity between a suite of metavolcanics and metasediments. Barron et al. (1989) indicate the metavolcanics at the Springpole property consist of an assemblage of alkalic flows and vent-proximal pyroclastic rocks, overlain by a sövitic, fluorite-bearing carbonatite, situated at the base of the overlying metasediments. The alkalic metavolcanic assemblage is intruded by syenitic and lamprophyre dikes (Barron et al. 1989).

Exploration work by Gold Fields has concentrated on the Portage zone which includes a number of gold mineralized zones. The Portage zone is a wide, west-northwest-trending, brittle-ductile shear zone which affects all lithologies on the property. It has a minimum strike length of 3800 feet. Alteration of the host rocks consists of carbonate, iron carbonate, chlorite, biotite and sericite. Gold mineralization occurs with pyrite and associated sulphides including chalcopyrite, galena, arsenopyrite, tetrahedrite, silver telluride and molybdenite. Empirical data indicate gold values increase towards the feldspar-porphyry intrusion.

Significant drill intersections encountered in the Portage zone include 0.1 ounce gold per ton across 65 feet, 0.03 ounce gold per ton across 340 feet, 0.07 ounce gold per ton across 120 feet, 0.86 ounce gold per ton across 5.5 feet, 0.60 ounce gold per ton across 7.2 feet and 0.107 ounce gold per ton across 10 feet.

Shanty Bay Occurrence

The Shanty Bay occurrence is located 1 km west of Shanty Bay, a part of Woman Lake, in Dent Township. The occurrence is located approximately 70 km east of Red Lake. Access to the site is via the South Bay Mine road to Woman Lake, then by a 22 km boat trip up the Woman River into Woman Lake and Shanty Bay. Aircraft access provides an alternate route.

Previous work on file on the Shanty Bay occurrence includes a magnetic survey and diamond drilling by Dougron Gold Mines Ltd. in 1948. Stripping, trenching, sampling, mapping and geophysics were completed by Sherritt Gordon Mines Ltd. in 1983. A small drill program on the property was completed by Sherritt Gordon; this core is in storage in the Kenora Drill Core Library.

The property is underlain by mafic metavolcanics and chemical metasediments of the Uchi Subprovince of the Superior structural province. All rocks are of Archean age. The occurrence lies within cycle two-aged rocks as described by Thurston (1985).

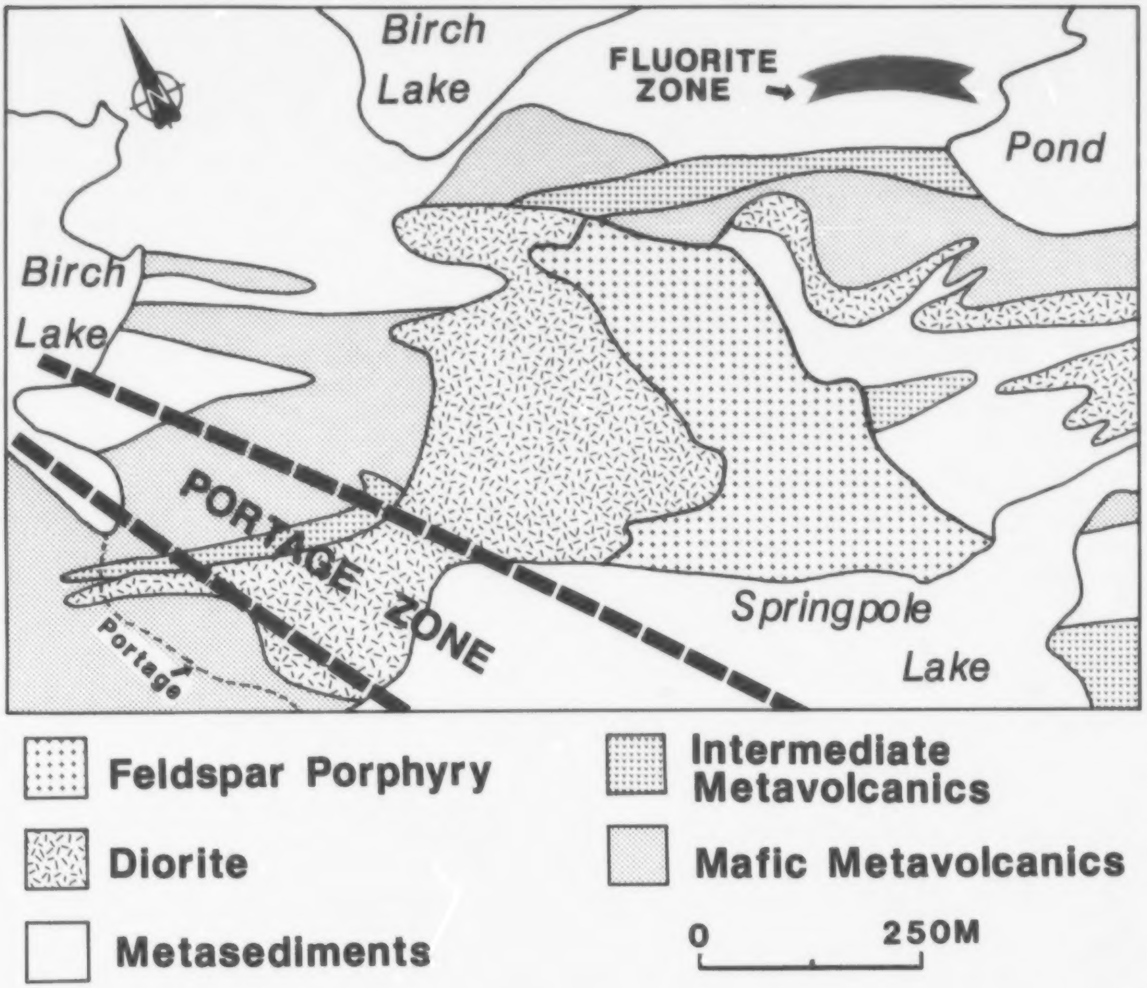


Figure 3.5. Geology of the Springpole property.

The mineralized occurrence on the property consists of mafic metavolcanic flows and north-trending, sulphidized, jasperoidal chert and argillaceous metasediments. A northeast-trending quartz-feldspar porphyry dike crosscuts rock types. The chemical metasediments can be traced southwards along a strike length of 12 km. The most southern extent of the chemical metasediments is a magnetite-chert iron formation that outcrops on Medicine Rock in the southern half of Woman Lake. In the immediate locale of the Shanty Bay occurrence, a large area has been power-stripped by Sherritt Gordon in 1983. This area was mapped in detail by the first author and is illustrated in Figure 3.6.

Geology in the stripped area, from west to east, includes a 5 m wide unit of pyritic, black, argillaceous metasediments enclosed by very thinly bedded jasperoidal chert. The chert unit consists of alternating white and red hematitic beds, some of which are brecciated. Discontinuous mafic dikes intrude the chert and argillaceous units. The chert unit is in contact with strongly iron carbonatized mafic metavolcanics on the east. Due to intense alteration of the metavolcanics, no primary textures are preserved. A crosscutting quartz-feldspar porphyry dike has intruded both the mafic metavolcanic and the jasperoidal chert unit. The dike varies in width from 3 to 5 m, strikes northeast and dips vertically. The dike is variably mineralized with pyrite, and pyrite mineralization is most pronounced at the intersection of the dike with the chert-mafic metavolcanic contact. A quartz vein on the west side of the dike appears to limit pyritization of the chert unit to the west.

A series of bedrock trenches have been blasted on the outcrop and these have been extensively sampled by various companies. Several trench samples collected by the author analyzed between 24 and 9920 ppb Au per ton

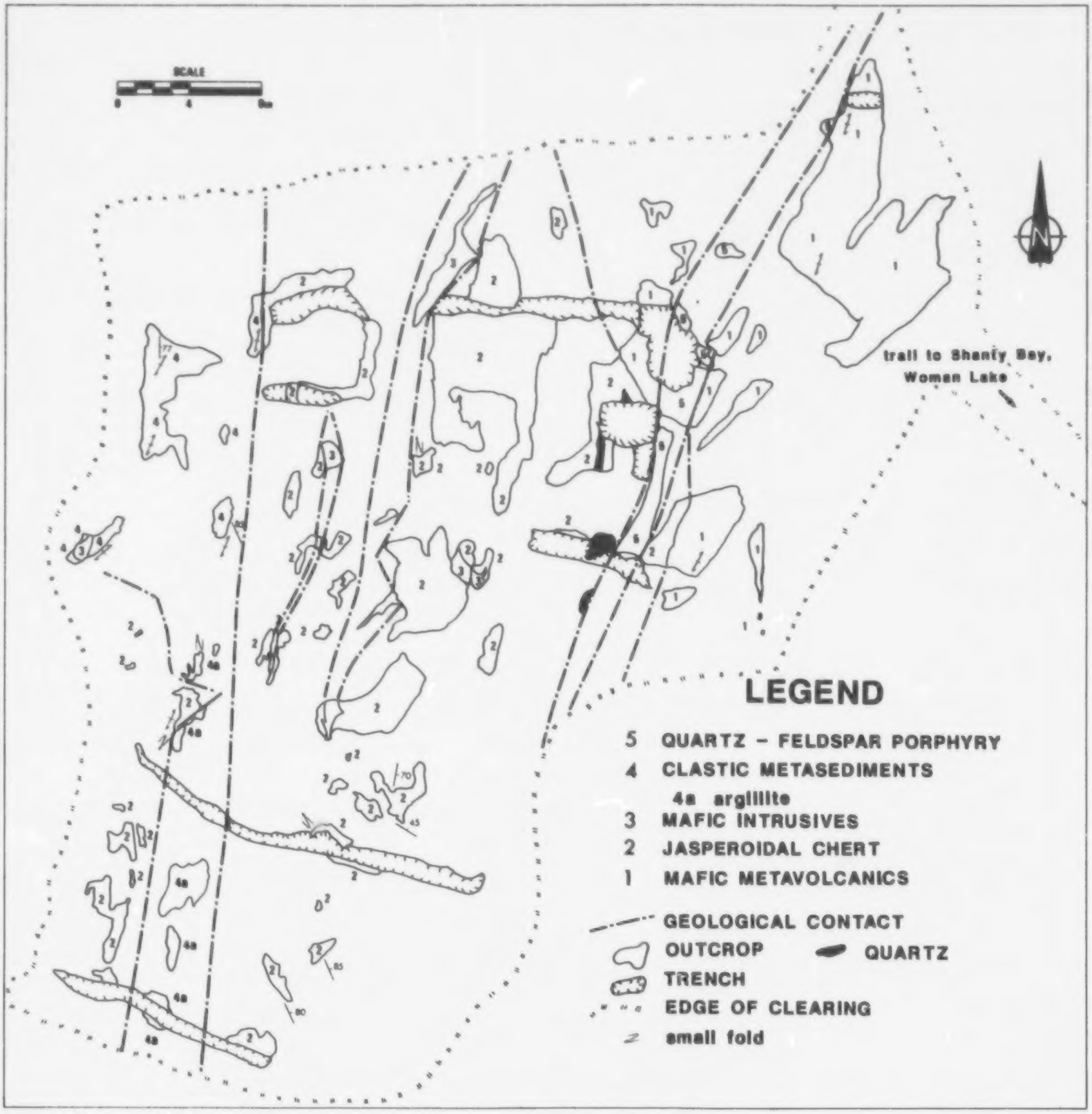

SCALE
0
4
8m
trail to Shanty Bay, Women Lake
LEGEND
5 QUARTZ - FELDSPAR PORPHYRY
4 CLASTIC METASEDIMENTS
4a argillite
3 MAFIC INTRUSIVES
2 JASPEROIDAL CHERT
1 MAFIC METAVOLCANICS
GEOLOGICAL CONTACT
OUTCROP
QUARTZ
TRENCH
EDGE OF CLEARING
small fold

Figure 3.6. Geology of the Shanty Bay occurrence—Dent Township.

(Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

BASE METAL OCCURRENCES AND PROSPECTS

A number of base metal occurrences and prospects in the Red Lake greenstone belt were researched and examined, as part of an ongoing study of base metal mineralization in the western Uchi Subprovince, by the staff of the Red Lake Resident Geologist's office. Four base metal occurrences are described below.

A.S. Creighton Occurrence

The A.S. Creighton occurrence is located on the south shore of Pipestone Bay, at the west end of Red Lake, in Ball Township. The occurrence is about 900 m west of Pipestone Narrows and is presently encompassed by mining claim KRL 827863 (formerly patented mining claim KRL 1712). The occurrence is indicated as a pyrite, pyrrhotite, chalcopyrite, silver, nickel, cobalt and zinc showing on Map 2265 (Riley 1975).

Gold exploration has been conducted in the vicinity of the A.S. Creighton occurrence since the 1930s, but the occurrence has only received minimal exploration attention.

Amcan Explorations Limited conducted exploration over 11 contiguous mining claims, encompassing the A.S. Creighton occurrence, during 1961. A trench was reported to have been sunk on the occurrence in iron formation containing pyrite and pyrrhotite, but no gold values were reported.

Gold Fields Exploration Canada Limited conducted ground magnetic and VLF-EM surveys over 33 claims encompassing the A.S. Creighton occurrence in 1981.

Shane Resources Ltd. conducted geological mapping, lithogeochemical and humus sampling over a group of 46 contiguous mining claims, encompassing the A.S. Creighton occurrence, during 1986 and 1987.

Local geology in the vicinity of the occurrence includes mafic metavolcanics and metasediments and ultramafic intrusions. The intrusions are comprised of serpentinized, carbonatized and talcose pyroxenite and peridotite exposed along the south, east and west shores of Pipestone Bay (Riley 1970, 1975). The ultramafic rocks intrude a bimodal succession of tholeiitic basalts and calc-alkalic rhyolites (Wallace et al. 1986) intercalated with mixed units of siltstone, chert-magnetite iron formation, argillite and minor sandstone (Riley 1970).

A narrow, deep trench was sunk on the occurrence and exposed recrystallized chert-magnetite iron formation trending about 150°. Chert beds up to 1.2 m thick are interbedded with narrow, discontinuous layers of black magnetite. The recrystallized chert is white to grey, granular and massive.

The iron formation is intercalated with massive mafic and felsic flows which are variably sheared at 125/90. The mafic metavolcanics are dark green, contain fibrous actinolite and are chloritic where they are intensely sheared. The iron formation and metavolcanics are intruded by massive, fine-grained, serpentinized, ultramafic rocks.

Sulphide mineralization consists of disseminated pyrite, pyrrhotite and minor chalcopyrite concentrated in the magnetite layers of the iron formation. A grab sample, taken by the second author from barren iron formation, analyzed less than 2 ppb Au and Ag, with 27 ppm Zn, 40 ppm Ni and 12 ppm Co. A grab sample of iron formation containing 2 percent disseminated pyrite and less than 1 percent chalcopyrite analyzed 12 ppb Au, 2 ppb Ag, 945 ppm Cu, 93 ppm Zn, 374 ppm Ni and 74 ppm Co. A grab sample of recrystallized grey chert containing 2 percent pyrite and some magnetite analyzed 25 ppb Au, 2 ppb Ag, 600 ppm Cu, 169 ppm Zn, 298 ppm Ni and 100 ppm Co (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Fisher Islands Occurrences

The Fisher Islands occurrences (also known as the Pine Option) are located in Fairlie Township on two of several islands, known as the Fisher Islands. The two islands are about 4 km southwest of McKenzie Island on Red Lake. The occurrences consist of several sulphide showings presently encompassed by mining claims KRL 790060 to KRL 790067 inclusive, KRL 775743, KRL 775774, and two patented mining claims KRL 11689 and KRL 11136.

The Fisher Islands occurrences dominantly consist of erratic copper, nickel, zinc, gold and silver mineralization associated with sulphides in metasediments and metavolcanics which were staked by C.F. Pine in the early 1960s.

Alcon Exploration and Mining Syndicate Limited diamond-drilled five holes totalling 555 feet on the larger of the two islands during 1961. Alcon Exploration and Mining Syndicate Limited and Dickenson Mines Ltd. also conducted diamond drilling in an area immediately west-northwest of the Fisher Islands occurrences in the early 1960s.

C.F. Pine conducted sampling, stripping and trenching on the two islands during 1969 and 1970.

Madsen Red Lake Gold Mines Ltd., in joint venture with Silvermaque Mining Ltd., conducted ground magnetic and vertical loop EM surveys over the occurrences, and diamond-drilled two holes totalling 1876 feet between 1970 and 1971.

C.W. Peterson diamond-drilled 26 holes totalling 8607.8 feet in the vicinity of the occurrences, during 1973, 1976 and 1977, and conducted stripping and trenching in 1973.

Gold Fields Exploration Canada Limited diamond-drilled seven holes totalling 3103 feet, in the vicinity of the occurrences, in 1982.

Homestake Mineral Development Company conducted airborne and ground magnetic and VLF-EM surveys immediately west of the occurrences in 1985.

Chevron Minerals Ltd. conducted a lake sediment geochemical survey on the property in 1986, and subsequently diamond-drilled three holes totalling 947.62 m during 1987. Stripping and sampling was also completed for selected outcrops.

The Fisher Islands occurrences are hosted by iron-rich metasediments and variably altered mafic metavolcanic flows, intruded by ultramafic dikes and sills dominantly consisting of pyroxenite and peridotite. The occurrences are located 300 m west of the contact between metavolcanics and granitoid rocks of the Dome stock (Riley 1978).

The majority of trenching and stripping, on the northernmost of the two islands, has been concentrated on sulphide-bearing, chert-greywacke-magnetite iron formation intruded by talcose, serpentinized, and variably carbonatized ultramafic rocks. Three separate units of recrystallized and amphibolitized iron formation are situated within the ultramafic rocks, on the northwest side of the island. The iron formation consists of chert, greywacke and green argillaceous metasediments interlayered with magnetite-rich layers. The cherty, magnetite-rich metasediments contain up to 5 percent disseminated pyrite, pyrrhotite, chalcopyrite and malachite, although in general, sulphides are relatively sparse. Some layers in the iron formation are completely replaced by very coarse aggregates of hornblende and dark green actinolite.

Ultramafic rocks, adjacent to the iron formation, are brecciated and contain small angular xenoliths of partially assimilated metasediments. The ultramafic rocks are dark green, soft, massive, contain abundant fibrous actinolite, and up to 2 percent disseminated pyrite, pyrrhotite and minor chalcopyrite.

Massive and pillowed mafic metavolcanic flows occur southeast of the iron formation and ultramafic rocks. The mafic flows are pale green, or white to buff-brown, due to variable calcite carbonatization and possible albitization. Pillows within the mafic flows are commonly variolitic and relatively unstrained.

Samples taken from surface exposures by Madsen Red Lake Gold Mines Ltd. assayed between 0.01 and 0.06 ounce gold per ton, 0.08 and 0.20 ounce silver per ton, 0.06 percent to 2.2 percent Cu and up to 0.06 percent Ni.

C.F. Pine obtained assays of 0.99 percent Cu and 0.15 percent Ni from the iron-rich metasediments, and reported gold assays as high as 4 ounces gold per ton from the occurrences.

No assay results were reported from any of the diamond drilling conducted in the vicinity of the Fisher Islands occurrences. The majority of holes intersected variably altered mafic and ultramafic rocks with weakly mineralized zones of quartz-carbonate veining. The majority of iron-rich metasediments, intersected in drill core, contained variable amounts of disseminated sulphides.

Riley (1971) obtained trace values of Au, Ag, Pb, Zn, Co and Ni from two random grab samples taken from the iron formation. One sample, taken by Riley (1971) from the north end of the iron formation, analyzed 0.27 percent Cu.

Two grab samples, taken by the second author, from barren iron formation, analyzed: 298 ppm Cu, 106 ppm Zn and 21 ppb Au; and 98 ppm Cu, 290 ppm Zn and less than 2 ppb Au. Two grab samples of pyritic iron formation analyzed: 520 ppm Cu, 475 ppm Zn and 20 ppb Au; and 1170 ppm Cu, 278 ppm Zn and 11 ppb Au. A grab sample of carbonatized ultramafic rock, adjacent to the iron formation, which contained 2 percent disseminated pyrite and pyrrhotite, analyzed 24 ppm Cu, 133 ppm Zn, 850 ppm Ni and less than 2 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

A trench at the north end of the southernmost island, has been sunk on a 0.45 to 0.92 m wide zone of intense iron carbonate alteration and silicification within mafic metavolcanic flows. The zone contains numerous narrow carbonate veinlets, and up to 5 percent, fine-grained, finely disseminated, pyrite, pyrrhotite and minor chalcopyrite with malachite staining. Two grab samples from the trench analyzed: 109 ppm Cu, 100 ppm Zn and 6 ppb Au; and 98 ppm Cu, 132 ppm Zn and 15 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Slate Bay Occurrence

The Slate Bay occurrence (also known as the Martin–McNeely occurrence or the Luxor Explorations Inc. property) is situated within a large group of contiguous patented mining claims located along the southeast shore of Slate Bay on Slate Peninsula, at the northeast end of Red Lake, McDonough Township. Two main showings known as the Silver zone, on patented mining claims KRL 2206 and KRL 2208, and the Gold zone, on patented mining claim KRL 2214, have been the focus of recent exploration.

Martin–McNeely Mines Limited conducted stripping and trenching on mining claims KRL 2206 and KRL 2208 in 1934. The work exposed a few quartz veins and intensely altered metavolcanics containing coarse crystalline hornblende, streaks of magnetite, abundant garnet and epidote, native copper and malachite (Hurst 1936).

Luxor Explorations Inc. conducted surface trenching, geological mapping, chip sampling and diamond-drilled seven holes totalling 2000 feet during 1936 and 1937. Five of the seven holes were drilled on patented mining claim KRL 2214. The company concentrated its work on several sulphide-bearing quartz veins ranging from 1 to 8 feet in width and assaying up to 0.10 ounce gold per ton (Horwood 1945). Horwood (1945) reported that the company had also exposed some sulphide zones up to 25 feet in width that assayed up to 0.04 ounce gold per ton. Luxor Explorations Inc. diamond-drilled five holes totalling 3400 feet on the property during 1946 and 1947.

Cochenour Exploration Limited conducted ground magnetic and EM geophysical surveys over a portion of the property, and diamond-drilled seven holes totalling 2100 feet on patented mining claims KRL 2206 and KRL 2208 during 1962. The company drilled two holes totalling 1400 feet in 1965, and drilled four holes totalling 1574 feet in 1966.

Bluestack Resources Limited in joint venture with Luxor Red Lake Mines Limited conducted ground magnetic and EM geophysical surveys, two trenching programs, soil and basal till geochemical surveys, geological mapping, and diamond-drilled six holes totalling 2578 feet on the property between 1981 and 1984.

The Silver and Gold zones at the Slate Bay occurrence are situated within a northeast-trending, northwest-facing sequence of metasediments, consisting of polymictic conglomerates interlayered with wackes, mudstones, slate and argillite intercalated with mafic tuff. The conglomerates are thickly bedded, exhibit normal grading, and are clast- and matrix-supported. The metavolcanics and metasediments are intruded by wide, northeast-trending, feldspar and quartz-feldspar porphyry dikes and a few gabbroic dikes. A large, trondhjemitic, quartz-porphyry intrusion (Pirie and Sawitzky

1977) is situated along the northwest shore of Slate Bay. The contact between the quartz porphyry and metasediments is interpreted to be about 300 m west of the Silver zone at the Slate Bay occurrence (Pirie and Sawitzky 1977).

The Silver zone has been stripped and trenched and consists of coarse-grained, polymictic pebble conglomerate, interlayered with thickly laminated to very thinly bedded wackes and mudstones, and some minor cherty or siliceous metasediments.

Metasediments at the Silver zone have been pervasively skarnified to a mineral assemblage of pink to brown, fine- to coarse-grained garnet; dark green, fibrous actinolite; blue-black magnetite; crystalline calcite; and pale green, fine-grained epidote. Alteration varies from garnet- to epidote-rich zones. The garnetiferous altered zone contains abundant disseminated chalcopyrite, pyrrhotite, pyrite and minor tetrahedrite and sphalerite with malachite and azurite staining.

A magnetite-epidote breccia containing bands of semimassive pyrite is overprinted by pervasive garnet alteration. Garnet also occurs along narrow fractures which intersect magnetite-epidote clasts within the breccia.

Intense green epidotization has pervasively replaced some of the fine-grained, thinly bedded metasediments at the Silver zone. The epidote-altered zones are up to 1.5 m wide and are parallel to the strike of bedding in the metasediments. The epidote is intimately interlayered with actinolite and/or magnetite-rich layers. No sulphide mineralization was observed in the epidotized zones.

Relatively unaltered, thinly bedded, grey-brown wackes are exposed immediately west of the most intensely altered zone. The metasediments are tightly folded with fold axes striking 304°, and plunging vertically. The metasediments are intersected by numerous, randomly oriented fractures less than 5 mm in width. The fractures contain dark green actinolite and are rimmed by narrow, white, alteration halos.

Quartz veins at the Silver zone strike 360° and 324° and contain disseminated pyrite, chalcopyrite, pyrrhotite and black tourmaline. Narrow, 2 to 3 cm wide halos of tourmaline extend outwards from the quartz veins.

Two grab samples, taken by the second author from the garnet-altered rocks at the Silver zone, containing between 5 and 10 percent sulphides consisting of pyrrhotite, chalcopyrite, tetrahedrite and pyrite analyzed: 3310 ppm Cu, 161 ppb Au and 0.35 ounce silver per ton; and 2.47 percent Cu, 375 ppb Au and 2.27 ounces silver per ton. Two grab samples of quartz vein material containing between 1 and 3 percent disseminated pyrite and chalcopyrite, analyzed 210 ppm Cu and 14 ppb Au, and 217 ppm Cu and less than 10 ppb Au (Temiskaming Testing Laboratory, Cobalt; Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Diamond drilling, conducted by Bluestack Resources Limited at the Silver zone, encountered erratic silver and gold values associated with sulphide mineralization in the intensely altered rocks. Silver values ranged between 0.05 and 3.44 ounces silver per ton with gold values as high as 0.13 ounce gold per ton.

The Gold zone at the Slate Bay occurrence dominantly consists of northeast-trending, sheared and tightly folded, biotitic and weakly carbonatized wackes interlayered with biotitized and carbonatized mafic metavolcanics. The metasediments are intruded by wide, northeast-trending, feldspar-porphyry dikes and a few, narrow, intensely altered ultramafic dikes. The metasediments are pyritic and host a few, very narrow, quartz veins.

Diamond drilling conducted by Bluestack Resources Limited in the Gold zone encountered erratic gold and silver mineralization with one intersection assaying 0.22 ounce gold per ton and 3.32 ounces silver per ton across 2 feet.

A grab sample, taken by the second author from the pyritic metasediments analyzed 16 ppb Au; a grab sample from pyritic and carbonatized metavolcanics analyzed 1240 ppb Au; and a grab sample from a pyritic, carbonatized, ultramafic dike analyzed 32 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto).

Trout Bay Prospect

The Trout Bay prospect is situated within a large group of contiguous, patented mining claims which extend along the southwest shore of Trout Bay, at the west end of Red Lake, in Mulcahy Township. The prospect consists of two separate mineralized zones situated 1.5 km due south of Trout Bay and northeast of Fahlgren Lake. The Zinc Pit Zn-Cu zone is situated on patented mining claims KRL 47696 and KRL 47697 and is about 300 m northwest of the Frog Pit Ni-Cu zone, situated on patented mining claims KRL 47698 and KRL 46941 (Riley 1976).

Cochenour Willans Gold Mines Ltd., in joint venture with Coin Lake Gold Mines Ltd. and Selco Exploration Ltd. (Shklanka 1969), optioned the Trout Bay property from W. Stupack and T. McVeigh in 1956. The company conducted a ground EM survey, geological mapping and some diamond drilling on a group of 160 contiguous mining claims during 1957. International Nickel Co. of Canada, Ltd. conducted a magnetic survey over the property for Cochenour Willans Gold Mines Ltd., also in 1957.

In 1960, a self-potential (SP) survey conducted by Cochenour Willans located the Zinc Pit and Frog Pit zones. The company had completed 14000 feet of diamond drilling and sunk several hundred trenches on the property by the end of 1961.

Falconbridge Nickel Mines Ltd. optioned the property in 1961 and completed geological mapping, a detailed magnetic survey, and diamond-drilled 58 holes totalling 25500 feet during 1962. Falconbridge subsequently dropped the option.

Conwest Explorations Co. Limited conducted trenching, geological mapping, ground EM, magnetic and SP surveys, and 759 feet of diamond drilling at the southeast end of the Frog Pit Ni-Cu zone in 1962 (Shklanka 1969).

Selco Exploration Co. Ltd. conducted airborne magnetic and EM surveys over the property in 1966 (Shklanka 1969).

Cochenour Willans Gold Mines Ltd. conducted trenching, a ground magnetic survey, and completed 12657 feet of diamond drilling on the Zinc Pit Zn-Cu zone during 1967 and 1968, following their discovery of a large faulted segment of the Zn-Cu mineralization (Shklanka 1969). The company conducted ground magnetic, horizontal loop EM and VLF-EM surveys over small portions of the property in 1971 and 1972. Cochenour Willans diamond-drilled 73 holes totalling 5383 feet in 1971 and 16 holes totalling 2206 feet in 1972.

The geology at the Trout Bay prospect generally consists of a metasedimentary assemblage of thinly bedded argillites, wackes, siltstones, sandstones and discontinuous layers of chert-magnetite iron formation intruded by wide, conformable, composite gabbro sills. The metasediments and gabbros are stratigraphically underlain and overlain by thick sequences of mafic metavolcanic flows intercalated with intermediate pyroclastic rocks (Riley 1968). The metavolcanic-metasedimentary assemblage strikes northwest for approximately 10 km along the southwest shore of Trout Bay. Metavolcanics are intruded by trondhjemitic to granodioritic rocks of the Douglas Lake stock, situated west of Trout Bay. The mineralized zones at the Trout Bay prospect are approximately 1.8 km east of the contact between the Douglas Lake stock and the metavolcanics (Riley 1976).

All of the supracrustal rocks in the Trout Bay area are variably metamorphosed from upper greenschist to lower amphibolite facies. Wackes, siltstones and sandstones contain variable amounts of garnet, anthophyllite, actinolite-tremolite, biotite and sericite. Argillaceous metasediments contain coarse staurolite, anthophyllite, cordierite, chiastolite, garnet, biotite and hornblende (Saukko 1962; Kuryliw 1963). Mafic metavolcanics commonly contain coarse-grained garnets, actinolite-tremolite and chlorite. Almost all of the gabbro sills in the area are composed of metamorphic hornblende and plagioclase (Kuryliw 1963).

The metasediments and chert-magnetite iron formation are tightly folded and variably sheared parallel to bedding, with numerous S- and Z-folds which have a shallow plunge to the west. Shearing and bedding commonly trend between 320° and 340°. The gabbro sills and the two mineralized zones are also folded with the metasediments.

Several east-northeast- and west-northwest-trending faults dislocate stratigraphy in the Trout Bay area (Riley 1968).

Base metal mineralization is widespread throughout the metavolcanic-metasedimentary assemblage southwest of Trout Bay. Almost all of the copper, nickel, zinc and silver mineralization in the Trout Bay area is associated with disseminated sulphides hosted by gabbro sills and by the metasediments which the gabbros intrude. Disseminated pyrite, pyrrhotite and chalcopyrite commonly occur in all types of metasediments at Trout Bay. The most abundant and highest grade base metal mineralization is situated northeast of Fahlgren Lake at the Zinc Pit and Frog Pit zones.

ZINC PIT ZONE

The Zn-Cu mineralization at the Zinc Pit zone has been separated into two mineralized sections which have been dextrally displaced by 800 feet along a fault trending 284° (Shklanka 1969).

A large trench known as the Zinc Pit has been sunk on the western part of the mineralized zone, on the south side of the fault. The eastern part of the mineralized zone, on the north side of the fault, does not crop out.

The Zn-Cu mineralization at the Zinc Pit is hosted entirely by tightly folded, silicified, fine-grained, argillaceous greywackes, and recrystallized, siliceous metasediments, at the contact with a thick gabbro sill. The massive gabbro adjacent to the mineralized zone is fine to medium grained and appears to be relatively unaltered. Kuryliw (1963) suggested that the Zn-Cu mineralization may be a replacement of chert-magnetite iron formation.

Narrow stringers of massive sphalerite and disseminated pyrite, pyrrhotite and chalcopyrite occur parallel to bedding in the metasediments. Mineralization consists of a central zone of massive sphalerite with minor chalcopyrite and galena, surrounded by a halo of disseminated pyrrhotite, pyrite and chalcopyrite, with thick stringers of massive pyrite. Cabri and Harris (1969) also identified arsenopyrite, cobaltite, stannite, argentian tetrahedrite, cassiterite and two new minerals with chemical formulas CoSbS and $NiSb_2$.

Drilling indicates the western mineralized body is about 20 feet thick by 100 feet in length and has been estimated to contain 13776 tons grading 4.75 percent Zn, 0.68 percent Cu, and 0.94 ounce silver per ton (Shklanka 1969). The eastern body is about 30 feet thick by 450 feet in length, and contains about 124760 tons grading 7.86 percent Zn, 1.5 percent Cu, 0.24 percent Pb, 1.7 ounces silver per ton and 0.007 ounce gold per ton. Neither mineralized zone could be traced below 200 feet in drilling (Shklanka 1969).

Two grab samples, taken by the second author, from the massive mineralized zone at the Zinc Pit analyzed 10.7 percent Zn, 2270 ppm Cu, 80 ppm Ni, 8500 ppm Pb, 19 ppm Ag and 271 ppb Au; and 12 percent Zn, 5200 ppm Cu, 28 ppm Ni, 5000 ppm Pb, 2.36 ounces silver per ton and 0.016 ounce gold per ton. Two grab samples from the disseminated sulphide zone at the Zinc Pit analyzed 23770 ppm Zn, 2.09 percent Cu, 28 ppm Ni, 244 ppm Pb, 2.06 ounces silver per ton and 39 ppb Au; and 4250 ppm Zn, 2060 ppm Cu, 74 ppm Ni, 270 ppm Pb, 18 ppm Ag and 136 ppb Au (Geoscience Laboratories Section, Ontario Geological Survey, Toronto; Temiskaming Testing Laboratory, Cobalt).

FROG PIT Ni-Cu ZONE

The Frog Pit Ni-Cu zone is exposed in trenches located approximately 300 m southeast of the Zn-Cu mineralized zones. The Ni-Cu mineralization occurs at the base of a composite gabbro sill, at or near the contact between the gabbro and a chert-magnetite iron formation. The mineralized gabbro and adjacent iron formation have been drag folded and sheared, and trend northwest for approximately 2.3 km.

Kuryliw (1963) recognized that the gabbro sill was differentiated into a pyroxenitic base, central noritic phase, and a micropegmatite-gabbro phase in the upper portion of the sill. The gabbro has been pervasively metamorphosed and is almost entirely composed of metamorphic hornblende and plagioclase. The hornblende is commonly uralitized to actinolite-tremolite (Kuryliw 1963).

Mineralization occurs in the pyroxenitic base of the gabbro sill, which has been metamorphosed and altered into a tremolite-antigorite-magnetite schist. The mineralization is intensely sheared and consists of disseminated and semimassive sulphides which occur in small, elongate lenses and narrow bands, parallel to the foliation, as well as in fractures which intersect the foliation. Sulphide mineralization includes chalcopyrite, pyrrhotite, pyrite and pentlandite (Kuryliw 1963). Chalcopyrite halos occur around pentlandite-rich lenses in intensely altered portions of the mineralized zone (Shklanka 1969).

The mineralized zone is 400 feet long, with a maximum thickness of 30 feet, and has an approximate grade of 0.5 percent Ni and 0.25 percent Cu. The deepest drill intersection which encountered this zone was at a vertical depth of 460 feet (Shklanka 1969).

Kuryliw (1963) also reported the presence of a Ni-Cu zone at the base of a gabbro sill which extends along the northeast shore of Fahlgren Lake. The zone hosts widespread mineralization consisting of disseminated, interstitial blebs of pyrrhotite, pentlandite and chalcopyrite.

DRILL CORE STORAGE PROGRAM

The Drill Core Library facilities for the Red Lake Resident Geologist's district are provided by the Kenora Drill Core Library. Core collected from the Red Lake District between November 21, 1988, and December 31, 1989, totalled 9333.9 m.

Currently, the library holds 17340.1 m of core from Red Lake; 8612.0 m of completely catalogued core is held in inside storage, 2260.7 m in secure outdoor storage, and an additional 6467.4 m of core is temporarily stored in the community of Red Lake.

Core from a total of 85 drill holes from the Red Lake District is in the main part of the collection. A listing of core archived in the Kenora Drill Core Library is presented in Table 3.3.

The last remaining core from the South Bay Mine was added to the collection in 1989. This consists of core from 7 underground holes, 6 from the 900-foot level and 1 from the 1200-foot level. These holes were drilled in 1975.

Core was recovered from several properties in the Birch, Confederation and Woman lakes areas (*see* Figures 3.2a and 3.2b). This core was all drilled for gold exploration and includes older work by Sherritt Gordon Limited (1983) in the Shanty Bay area of Woman Lake (refer to Property Examinations—Shanty Bay Occurrence section) and BP Canada Inc. (1985) at Seagrave Lake plus recent work by Falconbridge Limited at Grace Lake and Silverside Resources Inc. on Confederation Lake.

A large amount of assessment credit core samples from the older drilling in the Red Lake area are now stored in the core library. These samples are the only core remaining from some drill projects. Teck Corporation and its joint venture partners, Halley Resources Ltd. and Newfields Minerals Inc., carried out a deep drilling project on the Howey Mine property in Red Lake. Core from this work is presently stored in the community of Red Lake.

RECOMMENDATIONS FOR EXPLORATION

STULL LAKE GREENSTONE BELT

The alteration style and numerous gold occurrences of the Stull Lake greenstone belt are evidence of a high mineral potential. The potential is further enhanced by the delineation of a gold inventory of 1 million tons of mineralization grading 0.30 ounce gold per ton in the Little Stull Lake area of Manitoba by Westmin Resources Ltd., Tanqueray Resources Ltd. and Eastaurum Mines (The Northern Miner, September 4, 1989).

Exploration of Stull Lake should be directed towards gold in the north part of the belt, particularily in a zone of iron carbonate alteration that extends 2 km southwards from the Ellard occurrence.

Gold exploration should also focus on the Wynne Bay deformation zone where a number of gold occurrences in high-strain zones are delineated. The Wynne Bay deformation zone may be directly related to the Stull Lake-Wunnummin Lake fault zone. Hence, the Wynne Bay deformation zone may be part of a much larger crustal structure, enhancing it's mineral potential.

The Stull Lake greenstone belt has had past exploration for base metals. A number of holes have been drilled on the lake, some of which encountered Cu-Zn mineralization. Base metal mineralization should be sought in the vicinity of the Yvonne occurrence where rocks are intensely epidotized and carbonitized. Also, felsic pyroclastic rocks and associated conglomerates

TABLE 3.3. SUMMARY OF CORE FROM THE RED LAKE RESIDENT GEOLOGIST'S DISTRICT IN THE KENORA DRILL CORE LIBRARY.

Area	NTS	Company	Holes
Balmer Township	52N/04 SE	Eldor Resources	3
	52N/04 SW	Golden Exploration & Dev. Co.	3
	52N/04 SE	Granges Exploration	8
	52N/04 SW	Gunnar Gold Inc.	4
Bateman Township	52N/04 NE	Penway Explorers Ltd.	9
Bruce Lake	52K/14 SW	Griffith Mine	8
Buckett Lake	53C/10 SW	Rockspan Resources Ltd.	4
Dent Township	52N/02 SE	Selco Mining Corp. Ltd.	7 *
		Sherritt Gordon Mines Ltd.	3 *
		Silverside Resources	3 *
Dome Township	52N/04 SW	Sherritt Gordon Mines Ltd.	9
		Sherritt Gordon Mines Ltd.	6 *
Fairlie Township	52N/04 SW	Minorex Ltd.	1
		Selco Mining Corp. Ltd.	1
		Sherritt Gordon Mines Ltd.	1
Gerry Lake	52K/14 NE	Noranda Exploration Co. Ltd.	1
Grist Lake	53C/04 NW	Cominco Ltd.	3
Heyson Township	52N/04 SW	Selco Mining Corp. Ltd.	1
		Teck Corporation	6 * (*)
Kippen Lake	53G/05 SW	Eldor Resources Ltd.	5
Mitchell Township	52N/02 SE	St. Joseph Exploration Ltd.	1
Seagrave Lake	52N/08 SE	BP Resources Canada Ltd.	4 *
Shabumeni Lake	52N/07 SE	Falconbridge Ltd.	5*
		Marilyn Resources Ltd.	4
Slate Lake	52K/15 NE	Noranda Exploration Co. Ltd.	7 *
South of Otter Lake	52K/14 NW	Selco Mining Corp. Ltd.	4

* *Indicates core added during 1989.*

(*) *Core temporarily stored in the community of Red Lake.*

with felsic volcanic clasts should be explored for base metal mineralization.

Although the Stull Lake greenstone belt seems remote, land use conflicts are minimal, much ground is available for staking, and a winter road links the area to the Manitoba highway network. The Stull Lake greenstone belt deserves attention from the exploration industry.

DIXIE LAKE AREA

Much attention has focussed on the Dixie Lake area as a result of exploration success by Mutual Resources Ltd. and Teck Corporation. Mineralization occurs in a suite of rocks consisting of mafic metavolcanics and intercalated chemical and clastic metasediments on the east side of the Longlegged Lake dome. Prospectors and exploration geologists should note that gold occurrences have been documented in similar rock types on the west side of the Longlegged Lake dome in the vicinity of Dedee and Sydney lakes. At the time of writing, no claims have been recorded in these road accessible areas. The authors suggest that the Dedee-Sydney lakes area should be explored for additional gold mineralization.

BASE METALS IN THE RED LAKE GREENSTONE BELT

All of the base metal occurrences and prospects that were examined are relatively small contact-metamorphic deposits. The A.S. Creighton and Fisher Islands occurrences consist of anomalous and low-grade base metal mineralization, in chert-magnetite iron formation, intruded by ultramafic rocks. The Trout Bay Zn-Cu zone is a base metal sulphide replacement of chert-magnetite iron formation intruded by a gabbro sill.

The Silver zone at the Slate Bay occurrence appears to be a small base metal skarn, resulting from the addition of silica and iron to carbonate-rich metasediments. The large trondhjemitic quartz-porphyry intrusion at Slate Bay may have been a source for the hydrothermal solutions which skarnified the metasediments. These deposits are not the only type of base metal mineralization in the Red Lake greenstone belt, but the majority of base metal occurrences and prospects, especially at the west end of Red Lake, are contact-metamorphic base metal deposits.

Skarn-type mineralization, similar to the Slate Bay occurrence, may also occur at the northeast end of Pipestone Bay in Ball Township, where Riley (1970) mapped a unit of interbedded diopside skarn and pyrrhotiferous chert up to 200 feet thick. The metasedimentary unit occurs near the contact with granitic rocks of the Hammell Lake batholith and is also intruded by gabbro sills (Riley 1975).

Potential for the discovery of base metal sulphide replacement of iron formation exists anywhere in the Red Lake greenstone belt where chert-magnetite iron formation is intruded by mafic and/or ultramafic rocks.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

D. Stone continued geological mapping of the Berens River Subprovince. Mapping at a scale of 1:50000 was initiated on four map sheets west of, and including part of the Favourable Lake greenstone belt. Mapping also continued on several map sheets on the north side of the Red Lake greenstone belt at the same scale. Mapping of the Cobham Lake, Borland Lake, Kirkness Lake and Nungesser River map sheets is now completed.

RESEARCH BY OTHER AGENCIES

K.M. Barron, University of Western Ontario, continued doctoral research on the Springpole Lake alkalic volcanic complex (refer to Property Examinations—Springpole Property section).

J. Stix, University of Toronto, continued studies on subaqueous volcaniclastic rocks in the Confederation Lake area, with the aim of distinguishing between pyroclastic and epiclastic emplacement.

Both the above mentioned research projects are reported on in the *Geoscience Research Grant Program, Summary of Research 1988–89* (Milne 1989).

B.L. Gulson, CSIRO Division of Exploration Geoscience, Australia, completed lead isotope investigations of select mineralized samples from the Red Lake greenstone belt.

P.G. Silver and associates, with the Carnegie Institution of Washington, Washington D.C., USA, and associates from the University of Madison, Wisconsin, conducted a multisite teleseismic field experiment using portable instruments to determine the properties of the subcontinental upper mantle. The survey deployed a series of seismic instruments along a 1000 km line extending from Favourable and North Spirit lakes in the Sachigo Subprovince to the Black Hills of South Dakota, USA. In the Red Lake District, five monitoring sites were installed and correlated with the permanent Red Lake seismic monitoring station. Partial funding for the study was provided by the Ontario Geological Survey.

TABLE 3.4. MAPS AND REPORTS PERTAINING TO THE RED LAKE RESIDENT GEOLOGIST'S DISTRICT, ISSUED BY THE ONTARIO GEOLOGICAL SURVEY, 1989.

Geological Report	
Report 256	Geology of the Slate Lake Area, District of Kenora (Patricia Portion)
Maps	
Map 49a (Reprint)	Red Lake (West Sheet), District of Kenora, Patricia Portion
Map 49b (Reprint)	Red Lake (East Sheet), District of Kenora, Patricia Portion
Map 2517	Slate Lake Area, District of Kenora, Patricia Portion
Open File Report	
OFR 5700	Geology of the Western Birch Lake Area, Kenora District, Patricia Portion
Preliminary Maps, Geological Series	
P.3117	Precambrian Geology of the Western Birch Lake Area, Northern Half, District of Kenora (Patricia Portion)
P.3118	Precambrian Geology of the Western Birch Lake Area, Southern Half, District of Kenora (Patricia Portion)
Northern Ontario Engineering Geology Terrain Study Maps	
Map 5105	Sydney Lake, Data Base Map, 52L/NE
Map 5107	Pakwash Lake, Data Base Map, 52K/NW
Map 5108	Slate Lake, Data Base Map, 52K/NE
Map 5111	Pakwash Lake General Construction Capability Map, 52K/NW
Map 5112	Churchill Lake, Data Base Map, 52J/NW
Miscellaneous Papers	
MP 142	Report of Activities 1988, Resident Geologists
MP 143	Geoscience Research Grant Program, Summary of Research 1988–1989
MP 144	Peat and Peatland Resources of Northwestern Ontario
MP 146	Summary of Field Work and Other Activities 1989

PUBLICATIONS RECEIVED, 1989

Beakhouse, G.P. 1989. Geology of the western Birch Lake area, Kenora District, Patricia Portion; Ontario Geological Survey, Open File Report 5700, 106p.

Beakhouse, G.P. and McNeil, A.M. 1989a. Precambrian geology of the western Birch Lake area, northern half, District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.3117, scale 1:15840.

—— 1989b. Precambrian geology of the western Birch Lake area, southern half, District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.3118, scale 1:15840.

Bowen, R.P. 1989a. Geology of the Slate Lake area, District of Kenora (Patricia Portion); Ontario Geological Survey, Report 256, 82p.

—— 1989b. Slate Lake area, District of Kenora (Patricia Portion); Ontario Geological Survey, Map 2517, scale 1:31680.

Garland, G.D. ed. 1989. Proceedings of exploration '87: third decennial international conference on geophysical and geochemical exploration for minerals and groundwater; Ontario Geological Survey, Special Volume 3, 914p.

Riley, J.L. 1989. Peat and peatland resources of northwestern Ontario; Ontario Geological Survey, Miscellaneous Paper 144, 175p.

REFERENCES

Barron, K.M., Duke, N.A. and Hodder, R.W. 1989. Petrology of the Springpole Lake alkalic volcanic complex; *in* Geoscience Research Grant Program, Summary of Research 1988–1989, Ontario Geological Survey, Miscellaneous Paper 143, p.133-145.

Bennett, G. and Riley, R.A. 1969. Operation Lingman Lake; Ontario Department of Mines, Miscellaneous Paper 27, 52p.

Breaks, F.W., Bond, W.D., McWilliams, G.H. and Gower, C. 1974. Operation Kenora–Sydney Lake, District of Kenora; *in* Summary of Field Work 1974, Geological Branch, Ontario Division of Mines, Miscellaneous Paper 59, p.17-36.

Cabri, L.J. and Harris, D.C. 1969. New minerals from an unusual antimonial assemblage from the Red Lake area, Ontario; Department of Energy, Mines and Resources, Report MS PP 69-17, 7p.

Corkery, M.T. 1981a. Little Stull Lake area; Manitoba Energy and Mines, Preliminary Map 1989K-1, scale 1:20000.

——1981b. Little Stull Lake area; *in* Report of Field Activities 1981, Manitoba Energy and Mines, p.43.

Downie, D.L. 1938a. Stull Lake sheet (east half), Manitoba and Ontario; Department of Mines and Resources, Map 451A, scale 1:253440.

——1938b. Stull Lake sheet (west half), Manitoba and Ontario; Department of Mines and Resources, Map 452A, scale 1:253440.

Good, D.J. 1988. Geology of the east half of the Birch Lake area, District of Kenora (Particia Portion); Ontario Geological Survey, Open File Report 5685, 119p.

Good, D.J., Dawson, D. and Wu, L. 1986. Precambrian geology of the Birch Lake area (eastern half), District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.2964, scale 1:15840.

Harding, W.D. 1936. Geology of the Birch–Springpole lakes area; Ontario Department of Mines, Annual Report, 1936, v.45, pt.4, p.1-33.

Horwood, H.C. 1945. Geology and mineral deposits of the Red Lake area; Ontario Department of Mines, Annual Report, 1940, v.49, pt.2, p.1-231.

Hurst, M.E. 1936. Gold deposits in the vicinity of Red Lake; Ontario Department of Mines, Annual Report, 1935, v.44, pt.6, p.1-52.

Kuryliw, C.J. 1963. The geology of the Trout Bay nickel deposits, Red Lake District, northwestern Ontario; unpublished MSc thesis, University of Manitoba, Winnipeg, 108p.

Milne, V.G. ed. 1989. Geoscience research grant program, summary of research 1988–1989; Ontario Geological Survey, Miscellaneous Paper 143, 237p.

Osmani, I.A. In Prep. A review of Proterozoic mafic dike swarms in Superior Province of Ontario; *in* The Geology of Ontario, Ontario Geological Survey, Special Volume.

Osmani, I.A. and Stott, G.M. 1988. Regional-scale shear zones in Sachigo Subprovince and their economic significance; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.53-67.

Pirie, J. and Sawitzky, E. 1977. McDonough Township, District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.1240, scale 1:12000.

Riley, R.A. 1968. Mulcahy Township (north half), District of Kenora (Patricia Portion); *in* Summary of Field Work 1968, Ontario Department of Mines, Miscellaneous Paper 22, p.10-12.

——1970. Ball Township, District of Kenora (Patricia Portion); *in* Summary of Field Work 1970, Ontario Department of Mines and Northern Affairs, Miscellaneous Paper 43, p.12-15.

——1971. Red Lake District; *in* Annual Report of Resident Geologist's Section Geological Branch 1970, Ontario Department of Mines and Northern Affairs, Miscellaneous Paper 46, p.65-86.

——1975. Ball Township, Kenora District; Ontario Division of Mines, Map 2265, scale 1:12000.

——1976. Mulcahy Township, Kenora District; Ontario Division of Mines, Map 2295, scale 1:12000.

——1978. Fairlie Township, Kenora District; Ontario Geological Survey, Map 2407, scale 1:12000.

Riley, R.A. and Davies, J.C. 1967. Operation Lingman Lake, Stull Lake sheet, District of Kenora (Patricia Portion); Ontario Department of Mines, Preliminary Map P.426, scale 1:126720.

Satterly, J. 1937. Glacial lakes Ponask and Sachigo, District of Kenora (Patricia Portion), Ontario; Journal of Geology, v.45, p.790-796.

——1938.Geology of the Stull Lake area; Ontario Department of Mines, Annual Report, 1937, v.46, pt.4, p.1-31.

Saukko, R.N. 1962. Report on Trout Bay Option Mulcahy–Ball townships, Red Lake District; unpublished report for Falconbridge Nickel Mines Ltd.

Shklanka, R. ed. 1969. Copper, nickel, lead and zinc deposits of Ontario; Ontario Department of Mines, Mineral Resources Circular 12, p.154-155.

Thurston, P.C. 1985. Physical volcanology and stratigraphy of the Confederation Lake area, District of Kenora (Patricia Portion); Ontario Geological Survey, Report 236, 117p.

Thurston, P.C., Cortis, A.L. and Chivers, K.M. 1988. A reconnaissance re-evaluation of a number of northwestern greenstone belts: evidence for an Early Archean sialic crust; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.4-24.

Wallace, H., Thurston, P.C. and Corfu, F. 1986. Developments in stratigraphic correlation: western Uchi Subprovince; *in* Volcanology and Mineral Deposits, Ontario Geological Survey, Miscellaneous Paper 129, p.88-102.

4. Sioux Lookout Resident Geologist's District—1989

D.A. Janes[1], G.W. Seim[2] and C.C. Storey[3]

[1]Resident Geologist, Sioux Lookout Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Sioux Lookout Resident Geologist's Office, Northwestern Region.

[3]Drill Core Library Geologist, Kenora Drill Core Library, Northwestern Region.

INTRODUCTION

A four-year trend of high levels of claim staking, mineral exploration and assessment work submitted in the Sioux Lookout Resident Geologist's District continued into the first quarter of 1989. For the remaining three quarters of 1989, changes in the Canada Income Tax Act provisions for flow-through financing of mineral exploration resulted in a down-turn of the level of exploration activity in the district (Table 4.1). Table 4.2 is a summary of claim staking and assessment credits received for 1989 in the Sioux Lookout Resident Geologist's District. Claim staking has dropped off from the levels of the previous four years, and the assessment credits submitted are approximately 60 percent of the amount received in 1988. While exploration is down from the level of the average for the past four years, it is still above the average of the past ten years.

Many junior exploration companies are having difficulty in funding new and continuing programs. Since at least 50 percent of exploration in the district is funded by junior companies, this has had a negative effect on exploration activity. One hopeful trend is that a number of medium to large companies are again examining and acquiring exploration properties. While most exploration is still centred on gold, the upsurge in base metal prices, and the continuing strong market for platinum, has resulted in an increase in the relative importance of these programs.

Sixty percent of exploration in the district is located north of 51° latitude and is based on precious metals. Activity is split evenly between precious and base metals in the southern part of the district.

One interesting development in 1988 and 1989 in the Sioux Lookout Resident Geologist's District is that exploration activity has occurred in all four major greenstone belts in the district. There is no road access to the two northern belts. Table 4.1 lists exploration activity within the district during the year. Figure 4.1 shows the exploration activity in the area during 1989.

The mining situation in the Sioux Lookout Resident Geologist's District is encouraging. Two gold mines have come into production within the last 15 months. The Golden Patricia Mine of Bond Gold Canada Inc. has completed a successful first year of production. The Dona Lake Mine of Placer Dome Inc. started up in the spring of 1989 and is now in full production. The Sturgeon Lake base metal camp now has one producing mine, the Lyon Lake Mine of Noranda Minerals Inc. The Lyon Lake Mine is sending ore to the Mattabi Mines Limited mill. The joint operation is profitable and has reserves sufficient for operation into 1991.

The Ontario Mineral Exploration Program (OMEP) has assisted in the financing of many exploration programs within the district in past years. OMEP has ended and the last programs active in the Sioux Lookout Resident Geologist's District are reported in Table 4.3.

MINING ACTIVITY

Mining operations were carried out at three locations within the Sioux Lookout Resident Geologist's District in 1989. Figure 4.2 illustrates the mining activity in the area in 1989.

In the Sturgeon Lake Mining Camp, the Mattabi Mine (of Mattabi Mines Limited) is owned by Noranda Inc. (60%) and Abitibi-Price Inc. (40%). The Mattabi Mine ceased operation in September 1988, due to exhaustion of ore reserves. The Lyon Lake Mine, owned by Noranda Minerals Inc., has continued in operation during 1989 and produced 376817 tons of ore, averaging 9.11 percent zinc, 1.24 percent copper, 4.57 ounces silver per ton, 1.11 percent lead and 0.013 ounce gold per ton. (M. Patterson, Mattabi Mines Limited, personal communication, 1989.) The Mattabi Mill produces zinc, copper and lead concentrates from the Lyon Lake ore by flotation processes. The mine presently employs approximately 220 workers and is tentatively scheduled to exhaust reserves in 1991. Recent development programs have held out some hope of increasing the reserves.

The Golden Patricia Mine, of Bond Gold Canada Inc., is located approximately 80 km west-southwest of Pickle Lake, near Muskegsagagen Lake. The mine complex achieved full production in October of 1988 and has completed its first successful year of full-scale production. The mine presently produces ore at a rate of 380 tons per day. The grade is in excess of the design value of 0.6 ounce gold per ton. The mine is expected to produce in excess of 72000 ounces of gold in 1989. The underground workings are accessed by two declines 1 km apart. They use a shrinkage mining method on their 1.4 m wide ore zone. Approximately 2 km of a potential 6 km strike length have been developed. Other gold-bearing zones have been discovered on the property and are undergoing exploration. The mine employs approximately 140 workers and is serviced by air, using

TABLE 4.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	007 Precious Metals Inc.	10 DDH totaling 973.8 m on Sturgeon Lake Property in the Squaw Lake area
2	007 Precious Metals Inc.	600 km airborne Mag. and VLF survey over Split Lake and Sturgeon Lake Properties
3	Acadia Mineral Ventures L.	I.P. survey and 6 DDH totaling 902.2 m on Vermilion Lake Property in Jordan Tp.
4	Allan Best	trenching on property in Jutten Tp.
5	Allan Best	trenching in 52J/08 SW (Undesignated Area #18)
6	Argyle Ventures Inc.	4 DDH totaling 414.2 m on Dorothy Lake Property in the Meen Lake area
7	Bayeura Mines L.	2 DDH totaling 216.8 m on property in the Dorothy Lake area
8	BHP-UTAH Mines L.	15 DDH totaling 1610.9 m, I.P. survey, geochemical survey, geological mapping on McVicar Lake Property in the McVicar Lake area
9	Bond Gold Canada Inc.	9 DDH totaling 839 m, 20 line km Max Min and soil geochemistry surveys on the Magpy Option
10	Bond Gold Canada Inc.	17 DDH totaling 1658 m, 400 line km Max Min and Mag. surveys on the Muskeg West Property, Meen Grid
11	Bond Gold Canada Inc.	40 DDH totaling 5477 m on the Golden Patricia Lease
12	Bond Gold Canada Inc.	6 DDH totaling 621 m on the Muskeg East Property
13	Bond Gold Canada Inc.	9 DDH totaling 722 m, geological mapping and 20 line km soil geochemistry survey on the Kapkichi and Jacknife blocks of the Jewett Lake Property
14	Camreco Inc.	1525 m diamond drilling on Goldlund Mine Property in Echo Tp.
15	Cominco L.	Geophysical and geochemical surveys on property in the McVicar Lake area
16	Esso Resources Canada L. [Homestake Mining (Canada) L.]	8 DDH totaling 884 m on Crow Best Option in the Tarp Lake area
17	Golden Eagle Resources Inc.	4 DDH totaling 577.0 m on McGruer Lake Property in the Seeseep Lake area
18	Goldhunter Resources Inc.	31 DDH totaling 4906 m on the Caviar Option in the Wright Lake area
19	H. J. Hodge Inc.	2 DDH totaling 235.9 m on Jay (Meen Lake) Property in the Meen Lake area
20	International Platinum Corp.	20 DDH totaling 3439.6 m on Nemeigusabins Lake Project near Big Trout Lake
21	Krigold Resources L.	6 km linecutting and geological mapping of trenches on the McEdwards Lake Property. Drill core from previous programs relogged, resampled and assayed
22	Little July Resources Corp.	6 DDH totaling 939.7 m, I.P. and geochemical survey, mechanical and hydraulic stripping and prospecting on Little July Falls property in the Collishaw Lake area
23	Milner Consolidated Silver Mines L.	42 line km linecutting, Mag., VLF, and Max Min surveys on property in the Duffell Lake area
24	Minnova Inc.	6 DDH totaling 1570 m, 56 km DEEPEM, 46 km Mag., and 14 km HLEM surveys on Sturgeon Lake West Property
25	Minnova Inc.	8 DDH totaling 2862 m on Firstloon Lake Property NW of Pickle Crow
26	Moss Resources L.	Airborne Mag. and EM survey, 40 km linecutting, Mag. and EM surveys, geological mapping, prospecting, hydraulic stripping and geochemical sampling on Houghton Creek Option in the Houghton and Evans Lakes areas
27	Noramco Explorations Inc.	973.8 m diamond drilling, geological mapping, 9.6 km linecutting, 19.3 km Mag., geological mapping, mechanical and hydraulic stripping, humus geochemical survey on Central Patricia Property
28	Noranda Exploration Co., L.	4 DDH totaling 3700 m, airborne mag., ground geophysics, lithgeochemistry and relogging core on properties in the Sturgeon Lake area
29	Noranda Exploration Co., L.	Geological mapping and lithogeochemical sampling in the Savant Lake area
30	Northern Dynasty Explorations L.	5 DDH totaling 925 m on the Kashaweogama Lake Property in the Armit Lake area
31	Northern Dynasty Explorations L.	9 DDH totaling 1634 m and fill-in geophysical surveys on the Misehkow River Property in the Achapi Lake area
32	Pantheon Minerals L.	7 DDH totaling 677.2 m on Nabem Lake Property in the Meen Lake area
33	Placer Dome Inc.	16 km VLF survey and geological mapping on Graniteboss Lake Property in the Wright Lake area
34	Placer Dome Inc.	2 DDH totaling 320 m on the Poisson-McCubbin Property in Poisson Tp. and the Grebe Lake and McCubbin Tp. area

TABLE 4.1. CONTINUED.

Number on Figure	Individual or Company	Activity
35	Placer Dome Inc.	6 DDH totaling 619.3 m, geological mapping, I.P., Mag. and VLF surveys on One Pine Option in Poisson Tp.
36	Placer Dome Inc.	Underground evaluation of the East Bay Zones at Opapimiskan Lake
37	Power Explorations Inc.	12 DDH totaling 1468.2 m on the Opapimiskan Lake Property in the Skinner Lake area
38	Power Explorations Inc.	24 DDH totaling 2450.6 m on the Randall Lake Property in the Randall Lake area
39	Power Explorations Inc.	32 DDH totaling 3196.1 m on the Ohman Property in the Little Ochig Lake area
40	Primrose Gold Resources Inc.	Mag., VLF and I.P. surveys with 7 DDH totaling 586.7 m on Sturgeon Narrows Property in Six Mile Lake area
41	Ray Ramsay and G. M. Hogg	Prospecting and sampling in the Armit Lake area
42	Redaurum Red Lake Gold Mines L.	Trenching on property optioned from R. Ramsay and G. M. Hogg in the Armit Lake area
43	Rio Algom Explorations L.	Linecutting, Mag. and VLF surveys in August Lake area
44	Santa Maria Resources L.	Mag. and VLF surveys on Muskegsagagen Lake Property in the Kawashe Lake area
45	Umex Inc.	151 km airborne Mag. and EM survey over Bamaji, Wesleyan and Fry Lakes areas
46	Umex Inc.	Detailed geological mapping on Beckington Lake Project in the Beckington Lake area

TABLE 4.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1974	1,011	3,223	5,659	38,049.0	6,255	102	44,604
1975	1,019	2,409	3,903	38,492.7	18,953	1,858	59,503.7
1976	1,105	1,120	3,958	27,111.0	11,555	185	38,851
1977	1,261	1,320	3,760	17,880.1	13,931	946	32,757.1
1978	2,018	765	5,084	33,371.3	57,501	600	91,472.3
1979	1,012	1,061	5,045	30,869	27,605.4	1,949	60,423.4
1980	3,485	1,391	7,068	42,633	13,524	10,800	66,957
1981	2,861	1,502	8,303	42,588	232,184	4,866	287,626
1982	842	1,766	7,737	35,486	73,486	13,900	167,289
1983	4,398	1,164	10,971	69,563.8	85,536.5	27,730	197,223.1
1984	5,009	4,074	10,625	42,425	113,830	24,941.1	205,214.64
1985	2,513	3,972	9,166	92,051	148,105	20,376	294,891
1986	7,815	3,046	13,935	109,952.4	263,118.4	29,245.4	429,481.5
1987	5,540	1,918	18,786	255,334.04	345,747.6	49,750	691,581.8
1988*	2,400	2,424	18,855	179,235.2	279,066.4	66,973.3	556,154.7
1989**	1,532	3,266	17,121	176,858.9	74,670.6	46,485.4	327,851.1

*Revised totals for 1988 year end **Totals to the end of November 1989

an on-site airstrip. The mill utilizes conventional grinding, gravity separation and cyanidation, with zinc precipitation to recover gold.

Control of the owner of the mine, Bond International Gold Inc., has been acquired by Lac Minerals Ltd., who now own 65 percent of Bond International Gold Inc. (The Northern Miner, October 23, 1989, p.1).

The Dona Lake Mine is owned by Placer Dome Inc. and is located 12 km southeast of the town of Pickle Lake. The mine is rated at 550 tons per day and employs approximately 130 workers. Dona Lake Mine started production in March 1989, and the mine will have processed 170000 tons by year-end, with a grade close to 0.2 ounce gold per ton. The mine is an underground operation accessed by a 235 m shaft. The mill uses semiautogenous grinding, a flotation circuit followed by cyanidation with gold recovery by carbon-in-pulp absorption and electrowinning. The development is now concentrated below the 200 m level, where the grade is better than the ore mined to date. (P. Gertzbein, Dona Lake Mine, personal communication, 1989.)

The Goldlund Mine, owned by Camreco Inc., is located 35 km south of Sioux Lookout on Highway 72. During the winter of 1988 and the spring of 1989, Camreco Inc. conducted a surface drilling program and a re-evaluation of previous drilling results for the mine

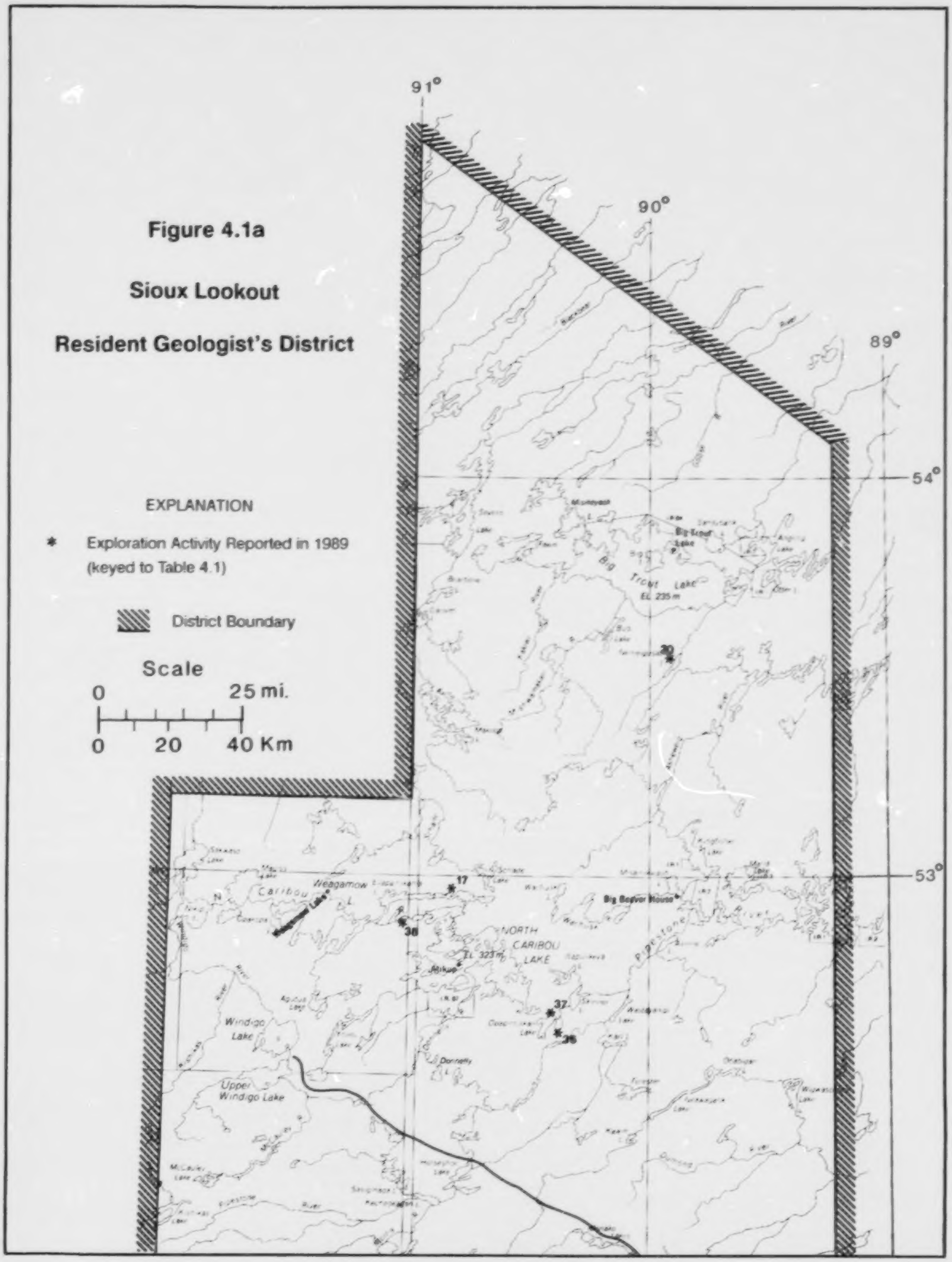


Figure 4.1a

Sioux Lookout

Resident Geologist's District

EXPLANATION
* Exploration Activity Reported in 1989 (keyed to Table 4.1)
District Boundary
Scale
0
25 mi.
0
20
40 Km
91°
90°
89°
54°
53°
Big Trout Lake
EL 235 m
30
17
38
37
36
Weagamow L
Caribou
Big Beaver House
NORTH CARIBOU LAKE
EL 323 m
Pipestone
River
Windigo Lake
Upper Windigo Lake
Donnelly L

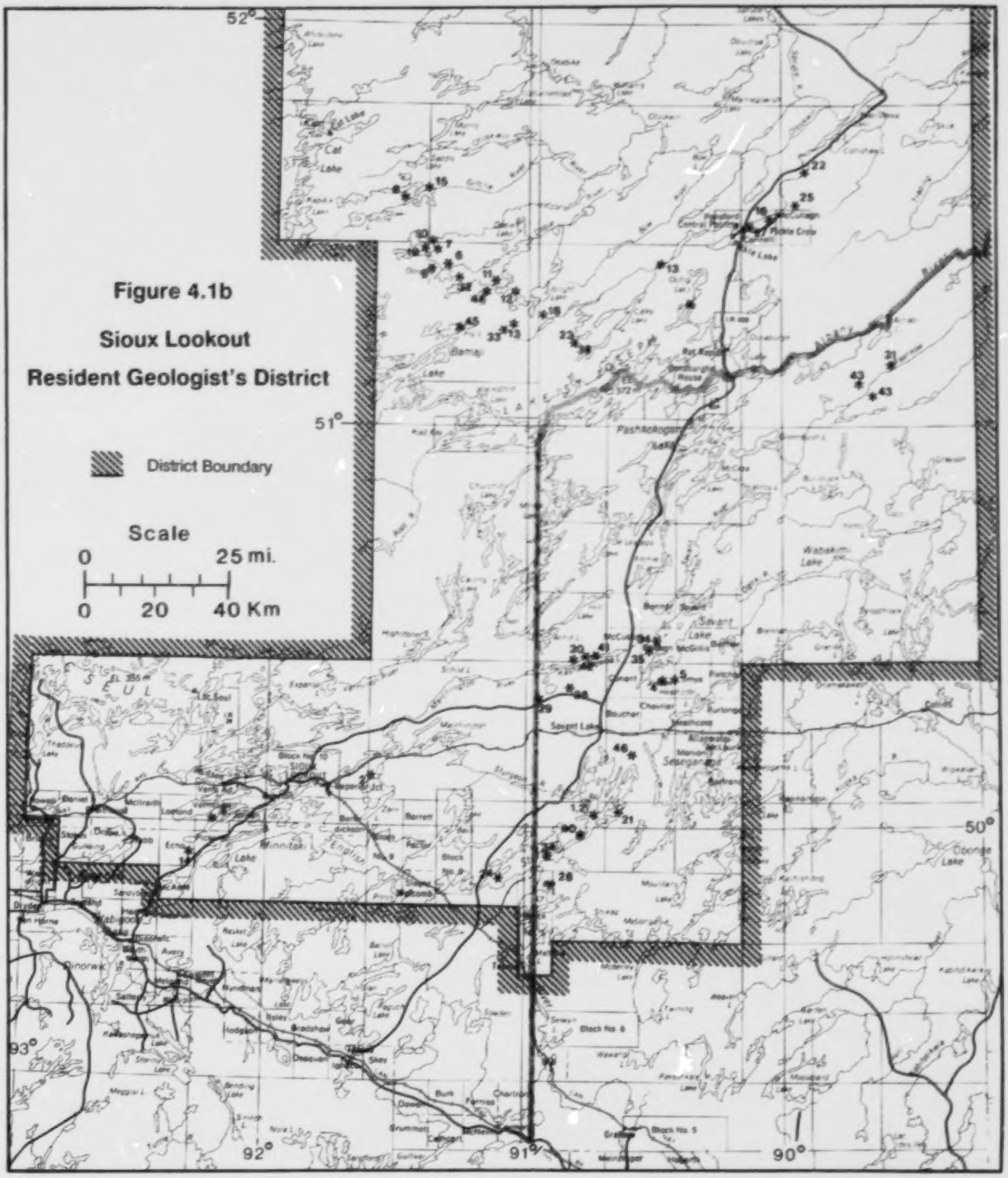


Figure 4.1b

Sioux Lookout Resident Geologist's District

District Boundary
Scale
0
25 mi.
0
20
40 Km
52°
51°
50°
93°
92°
91°
90°
Cat Lake
Pickle Crow
Central Patricia
Pashkokogan Lake
Savant Lake
Sturgeon Lake
Savant Lake
Lac Seul
Sioux Lookout
Minnitaki Lake
Wabakimi Lake
Ombabika Lake
Osnaburgh House
Block No. 5
Block No. 6
22
25
16
13
15
8
7
6
11
12
45
33
13
23
31
43
43
30
41
34
35
5
29
46
21
28

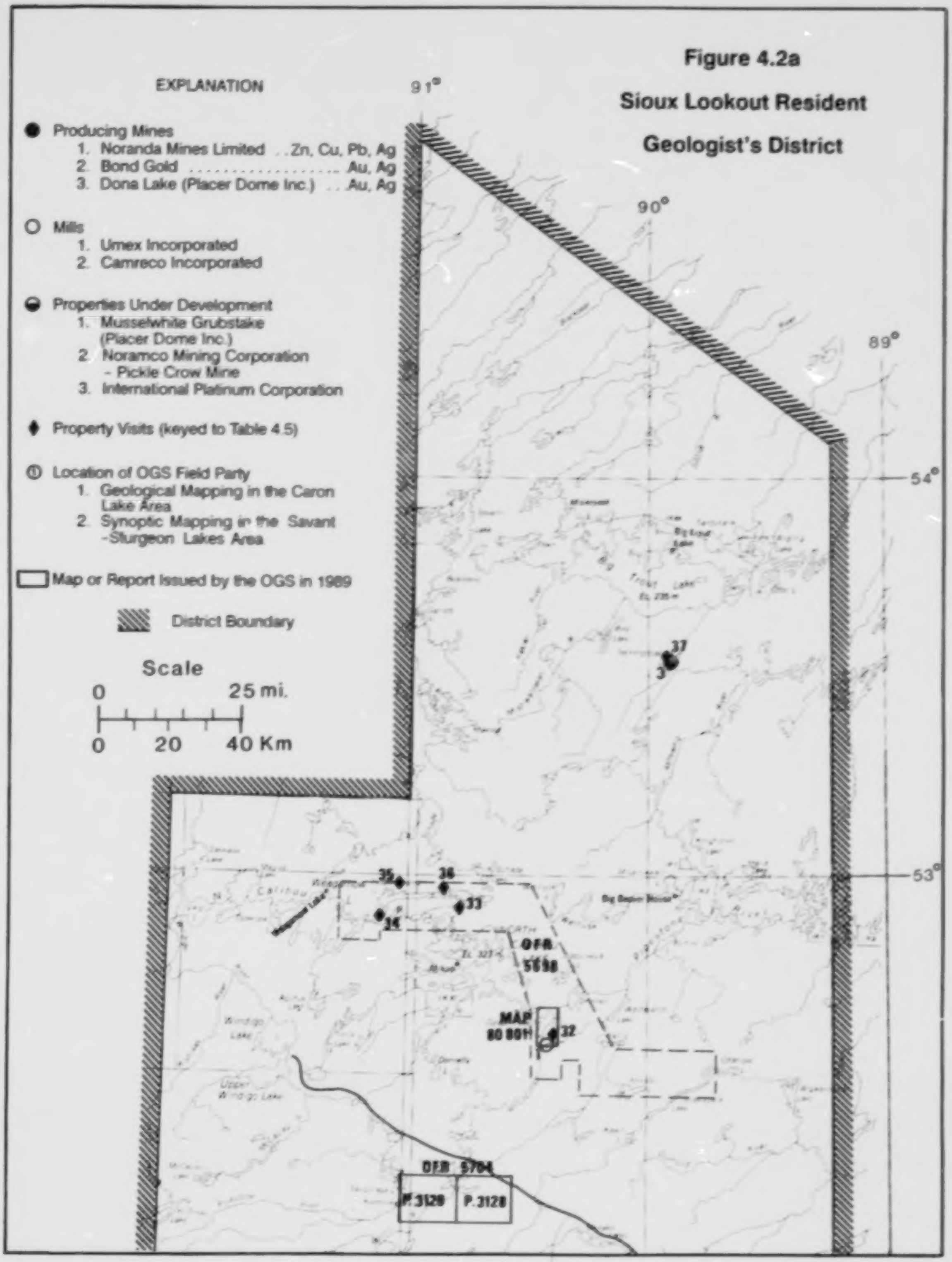

EXPLANATION
● Producing Mines
1. Noranda Mines Limited . . Zn, Cu, Pb, Ag
2. Bond Gold . . . . Au, Ag
3. Dona Lake (Placer Dome Inc.) . . Au, Ag
○ Mills
1. Umex Incorporated
2. Camreco Incorporated
◒ Properties Under Development
1. Musselwhite Grubstake (Placer Dome Inc.)
2. Noramco Mining Corporation - Pickle Crow Mine
3. International Platinum Corporation
◆ Property Visits (keyed to Table 4.5)
① Location of OGS Field Party
1. Geological Mapping in the Caron Lake Area
2. Synoptic Mapping in the Savant -Sturgeon Lakes Area
☐ Map or Report Issued by the OGS in 1989
▨ District Boundary
Scale
0
25 mi.
0
20
40 Km
91°
90°
89°
54°
53°
Big Trout Lake
37
3
35
36
33
34
Caribou
Big Beaver House
OFR 5698
Windigo Lake
Upper Windigo Lake
MAP 80 801
32
OFR 5704
P.3129
P.3128

Figure 4.2a

Sioux Lookout Resident Geologist's District

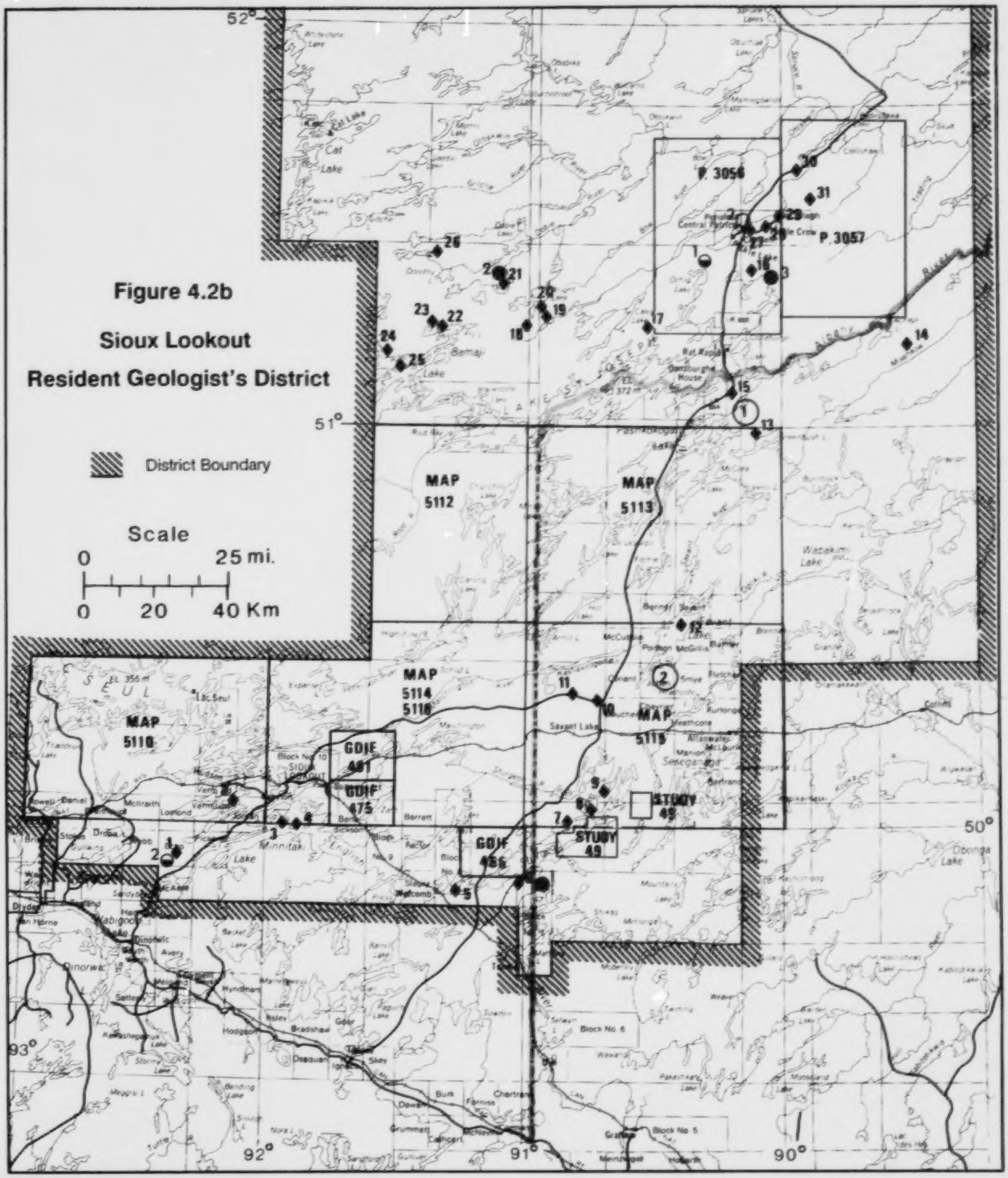


Figure 4.2b

Sioux Lookout Resident Geologist's District

District Boundary
Scale
0 25 mi.
0 20 40 Km
52°
51°
50°
93°
92°
91°
90°
MAP 5112
MAP 5113
MAP 5114 5110
MAP 5110
MAP 5115
P. 3056
P. 3057
GDIE 481
GDIF 475
GDIF 456
STUDY 49
Cat Lake
Bamaji Lake
LAKE ST. JOSEPH
Pashkokogan Lake
Wabakimi Lake
Savant Lake
Sioux Lookout
Minnitaki Lake
Lac Seul
Obonga Lake
Central Patricia
Pickle Crow
Rat Rapids
Osnaburgh House
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

TABLE 4.3. OMEP PROGRAMS IN THE SIOUX LOOKOUT RESIDENT GEOLOGIST'S DISTRICT.

LOCATION	TOTAL EXPENDITURES	OMEP ASSISTANCE
Kawashe Lake	$ 216,300	$ 54,075
McVicar Lake	611,250	152,812
Pickerel Tp.	11,600	2,900
Wright Lake	761,040	190,260
Fry Lake	372,000	93,000
TOTAL DISTRICT	$1,972,190	$493,047

and the neighbouring Windfall property. This work was to support a study to reopen the Goldlund Mine, which operated briefly between 1983 and 1985 and produced approximately 15000 ounces of gold. A 1988–1989 drilling program outlined an extension to an existing open-pit mine with a grade of 0.1 ounce gold per ton and 150000 tons of ore. Re-evaluation of previous work along with the recent drilling allowed a calculation of some 350000 tons of ore at 0.15 ounce gold per ton (Canadian Mines Handbook, 1989–90, p.89). In late September 1989, Camreco Inc. announced that they would not be proceeding immediately with a feasibility study to reopen the mine.

ADVANCED EXPLORATION AND DEVELOPMENT

Three properties fall into this classification within the Sioux Lookout Resident Geologist's District. These properties are:

1. Musselwhite Grubstake's East Bay zones on Opapimiskan Lake
2. Noramco Mining Corporation Pickle Crow property east of the community of Pickle Lake
3. International Platinum Corp. (IPCO), Nemeigusabins Lake Project, south of Big Trout Lake

Placer Dome Inc., operator of the Musselwhite Grubstake Mine completed an evaluation of the East Bay zones that started in 1988. The project included the sinking of a 235 m shaft, approximately 1800 m drifting, underground diamond drilling, a bulk sample and surface diamond drilling. The project was completed in March and the results of a feasibility study are pending. (R. Stewart, Placer Dome Inc., personal communication, 1989.) Placer Dome Inc. (43%), Inco Limited (32%) and Corona Corporation (25%) are the remaining partners in the Musselwhite Grubstake after buying Esso Resources Canada Limited's interest in May (The Northern Miner, May 22, 1989, p.A1). The published reserves prior to the feasibility study were a drill-indicated 6 million tons at 0.2 ounce gold per ton (The Northern Miner, May 1, 1989, p.6).

After evaluating the results of the past several years of work, conducted by Noramco Mining Corporation, the management decided that insufficient proven ore reserves existed in the Pickle Crow Mine to justify continuing with mine development. Accordingly, the underground workings were allowed to flood and the shafts were recapped. (D. Laderoute, Noramco Explorations Inc., personal communication, 1989.)

IPCO has carried out surface and drill exploration on their Nemeigusabins Lake property, some 13 km south of Big Trout Lake. The targets are several platinum-bearing zones within an Archean ultramafic to mafic layered complex. IPCO conducted extensive surface exploration and drilling programs for the past several years and have outlined at least one 6 km long zone, ranging from 3 to 7 m in width, which appears to contain potentially economic platinum group metals. The mineralized zones are essentially vertical and could be extracted by conventional shaft mining methods. IPCO considers that this property is their best platinum prospect in North America and estimate that an additional one or two drilling campaigns will be required before full-scale feasibility studies can be considered. IPCO will be returning to the property in early 1990. (I. Chisholm, International Platinum Corp., personal communication, 1989.)

EXPLORATION ACTIVITY

Exploration activity in the Sioux Lookout Resident Geologist's District, as previously stated, has generally been at decreased levels through 1989. However, the Savant–Sturgeon lakes area witnessed an increase in the level of exploration activity compared with 1988 levels. Several exploration companies examined the Marchington Lake to Savant Lake section of the Wabigoon Subprovince for its base metal potential and new claims were staked. The Central Uchi greenstone belt continued as the main focus of activity and a few new gold occurrences were announced during the year. Interesting assay values were also announced from properties in the North Caribou Lake greenstone belt and from IPCO's platinum prospect in the Big Trout Lake greenstone belt.

Acadia Mineral Ventures Limited conducted an induced polarization (IP) survey and a small diamond drilling program on their Vermilion Lake property. They were exploring for further gold mineralization in the vicinity of the Eimiller quartz-feldspar porphyry gold occurrence which they drill tested in 1988.

Both Minnova Inc. and Noranda Exploration Company, Limited, continued their efforts to locate new base metal deposits in the south Sturgeon Lake area. Minnova Inc. drilled six diamond-drill holes totalling 1570 m, 56 km of DEEPEM survey, 46 km of magnetic survey and 14 km of horizontal loop electromagnetic (HLEM) survey (P. Lewis, Minnova Inc., personal communication, 1989). Noranda Exploration Company, Limited, drilled four diamond-drill holes totalling 3700 m and relogged several previously completed diamond-drill holes. Noranda commissioned an airborne magnetic survey covering their ground in the south Sturgeon Lake area and did ground geophysical surveys and lithogeochemical sampling. (W. Reid, Noranda Exploration Company, Limited, personal communication, 1989.)

Primrose Gold Resources Inc. did magnetic and very low frequency electromagnetic (VLF-EM) surveys over their 25-claim block in the Sturgeon Narrows. An IP survey was done over selected areas of the property. Seven diamond-drill holes totalling 585.2 m tested the indicated targets. Anomalous gold was detected in some of the core. (J. Redden, Primrose Gold Resources Inc., personal communication, 1989.)

007 Precious Metals Inc. commissioned Aerodat Ltd. to fly a 600 km magnetic and VLF-EM survey over their Split Lake and Sturgeon Lake properties. 007 Precious Metals Inc. drilled nine diamond-drill holes to test gold-bearing quartz veins on Rainbow Island in Sturgeon Lake. Rainbow Island is approximately 22 km south of the village of Savant Lake. A single diamond-drill hole drilled from Hotel Point on Sturgeon Lake, 1 km south of Rainbow Island, encountered sporadic gold mineralization over a 76 m core length. The diamond-drilling program totalled 973.8 m. (R. Bernatchez, 007 Precious Metals Inc., personal communication, 1989.)

Krigold Resources Ltd. did 6 km of line cutting on their McEdwards Lake property, 3 km north of East Bay of Sturgeon Lake. Previously excavated trenches were mapped and diamond-drill core from previous exploration programs was relogged and resampled. This was to confirm the indicated auriferous character of an old exploration area on the south side of McEdwards Lake. (P. Sarkar, Krigold Resources Ltd., personal communication, 1989.)

Several area prospectors continued to examine and locate showings in the Sturgeon Lake and Savant Lake areas. They have indicated that they do not want their activities discussed in print, but do have properties available for option.

Umex Inc. continued to evaluate the Beckington Lake property, 10 km southeast of the village of Savant Lake. Umex Inc. did detailed geological mapping over a selected portion of the claim block. (F. Felder, Umex Inc., personal communication, 1989.) The Beckington Lake property is underlain by a metavolcanic succession with indicated base and precious metal potential.

Moss Resources Ltd. optioned the Houghton Creek gold occurrence from A. Best of Savant Lake. The Houghton Creek gold occurrence is located 13 km northwest of the village of Savant Lake. Additional claims were staked around the optioned claims and an airborne geophysical survey was flown in the spring. In the summer, Geocanex Ltd., under contract to Moss Resources Ltd., cut 40 line-kilometres of grid and did geophysical surveys, geological mapping and prospecting. The main showing was hydraulically stripped and then thoroughly channel sampled. The focus of the program was aimed at locating base metal targets as well as evaluating the gold prospect. (H. Hodge, Geocanex Ltd., personal communication, 1989.)

Redaurum Red Lake Mines Limited did trenching and sampling on the Kashaweogama Lake property, which is 19 km north-northwest of the village of Savant Lake. The property was optioned from G.M. Hogg and R. Ramsay. Trenching near Duck Pond on the property uncovered pyritic bands in a mudstone that assayed 1337 ppb gold. Trenching on the Sidore prospect opened up some narrow quartz veins that assayed up to 9.18 ounces gold per ton. The Redaurum Red Lake Mines' option agreement expired after the trenching program. Hogg and Ramsay then prospected eight new claims staked to the northwest of the Sidore prospect. Mafic metavolcanics containing shear- and vein-hosted pyrite and chalcopyrite assayed up to 650 ppb gold, 359 ppm copper, 82 ppm lead and 76 ppm zinc. (G.M. Hogg, G.M. Hogg and Associates Ltd., personal communication, 1989.)

Northern Dynasty Explorations Ltd. did a 925 m diamond-drilling program on their Kashaweogama Lake property 20 km north-northwest of the village of Savant Lake. (Westfield Minerals Ltd. is a joint venture partner on this property.) The drilling tested structures and geophysical anomalies associated with previously known and recently discovered gold showings. (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.)

Placer Dome Inc. did geophysical (magnetic, VLF and localized IP) and geological surveys (including hydraulic stripping) on the One Pine option on Savant Lake, 22 km northeast of the village of Savant Lake. Six diamond-drill holes totalling 619.3 m were completed late in the year. On Placer Dome Inc.'s Poisson–McCubbin (townships) property, two diamond-drill holes totalling 320 m were completed. (T. Lewis, Placer Dome Inc., personal communication, 1988.)

In February, Northern Dynasty Explorations Ltd. announced the discovery of gold mineralization in ironstone horizons on their Misehkow River property (George Cross News Letter, No. 26, Feb. 7, 1989). Westfield Minerals Ltd. and Newfields Minerals Inc. are joint venture partners on the property. Work this year included 1613 m of diamond drilling, fill-in geophysics and detailed geological mapping with special attention to structure (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989). The Misehkow River gold prospect is described in detail in the Property Examinations section.

Rio Algom Explorations Inc. has two claim groups covering the felsic metavolcanics south of the Webb Lake stock. Line cutting, magnetic and VLF surveys were done on the northern half of the east claim group and the southern part of the western claim group. (I. Downie, Rio Algom Explorations Ltd., personal communication, 1989.)

Geocanex Ltd. did a 32-hole, 3196.1 m, diamond-drilling program for Power Explorations Inc. and Champion Gold Resources Inc. on their Ohman property, 18 km southwest of Pickle Lake. The diamond drilling tested three subparallel geophysical anomalies at several points along their length. Geological mapping and prospecting in 1988 determined the anomalies to represent gold-bearing deformational-alteration-sulphide zones within a volcanic-sedimentary succession.

(H. Hodge, Geocanex Ltd., personal communication, 1989.)

E.W. Bazinet did 42 km of line cutting and geophysics (magnetic, VLF-EM and Max Min horizontal loop electromagnetic (HLEM)) on a claim group owned by Milner Consolidated Silver Mines Ltd. in the Diffell Lake area, 48 km southwest of the town of Pickle Lake. E.W. Bazinet did a geological survey of the claims as well.

Goldhunter Explorations Inc., Pinetree Explorations and Caviar Resources Limited announced the intersection of 1.83 m of 0.66 ounce gold per ton from drilling on their jointly owned claims east of Graniteboss Lake, which is 57 km east-southeast of the town of Pickle Lake (The Northern Miner, March 27, 1989, p.16). In 1988, Goldhunter Explorations Inc. drilled two diamond-drill holes totalling 248 m. In 1989, Goldhunter Explorations Inc. drilled 31 diamond-drill holes totalling 4906 m in two programs. (T.J. Beesley, Geological Services Inc., personal communication, 1989.)

Placer Dome Inc. completed a 16 km VLF-EM survey and geological mapping on their Graniteboss Lake claim group.

In 1988, Umex Inc. commissioned Terraquest Ltd. to fly a 151 km magnetic and electromagnetic survey over claims in the Bamaji–Wesleyan–Fry lakes area (F. Felder, Umex Inc., personal communication, 1989).

Bond Gold Canada Inc., a major claim holder in the Patricia Mining Division with 3145 claims, conducted exploration projects on five of their properties. On the Golden Patricia lease, the claims brought to lease around the Golden Patricia Mine at Muskegsagagen Lake, 5477 m of diamond drilling in 40 holes was completed. The drilling was targeted at extending the main ore zone and at other zones of mineralization. Six diamond-drill holes totalling 621 m were drilled on the Muskeg East property. The Muskeg West property and the Magpy option are located to the northwest of the Golden Patricia Lease. On the Muskeg West property, Bond Gold Canada Inc. did 400 line-kilometres of Max Min HLEM survey and 17 diamond-drill holes totalling 1658 m. On the Magpy option, Bond Gold Canada Inc. did 20 line-kilometres of Max Min survey and nine diamond-drill holes totalling 839 m. East towards Pickle Lake, Bond Gold Canada Inc. did 20 line-kilometres of geological mapping and soil geochemistry and nine diamond-drill holes totalling 722 m on the Kapkichi and Jackknife blocks of the Jewett Lake property. Jewett Lake is 51 km east-southeast of the town of Pickle Lake.

Argyle Ventures Inc. did four diamond-drill holes totalling 414.2 m on their Dorothy Lake property northwest of the Golden Patricia Mine. The diamond-drill holes tested a prominent iron formation horizon which strikes through the property. Samples of sulphide and oxide mineralization intersected in and adjacent to the iron formation assayed between 100 ppb and 700 ppb gold. (Vancouver Stockwatch, Wed. April 12, 1989.)

Bayaura Mines Limited drilled two diamond-drill holes totalling 216.8 m on claims in the Dorothy Lake area. Samples containing disseminated sulphides returned anomalous gold assay values. (O. Baykal, Bayaura Mines Ltd., personal communication, 1989.)

BHP-Utah Mines Ltd. did geophysical surveys (mainly IP), geochemical surveys and geological mapping on their McVicar Lake claim group which is 86 km east-northeast of the town of Pickle Lake. This work provided targets for a 15-hole, 1610.9 m, diamond-drilling program completed in the fall. (R. Thomas, BHP-Utah Mines Ltd., personal communication, 1989.)

Cominco Ltd. did geophysical and geochemical surveys on claims in the McVicar Lake area.

Noramco Mining Corporation, after downgrading the Pickle Crow property late in 1988, had Noramco Explorations Inc. concentrate work on the Central Patricia property. The work focussed on the Southwest Powderhouse Lake area where drilling had indicated a new zone of gold mineralization in iron formation. The program consisted of detailed geological mapping, stripping and trenching, geophysical and geochemical surveys over selected areas and 973.8 m of diamond drilling. (D. Laderoute, Noramco Explorations Inc., personal communication, 1989.)

Minnova Inc. continued with exploration on their First Loon Lake property 19 km northeast of the town of Pickle Lake. An eight-hole, 2862.1 m diamond-drilling program was completed on the property. (P. Lewis, Minnova Inc. personal communication, 1989.)

Homestake Mineral Development Company for Esso Resources Canada Ltd. did an eight-hole, 884.2 m diamond-drilling program on their "Pickle Crow" property located to the north of Central Patricia Mine. The drilling, done in April 1989, was targeted at the strike extensions of iron formation horizons which were previously identified on the property. In October, 40 km of grid lines were cut on the claims. Magnetic and Max Min HLEM surveys were done along the gridlines. (D. McIvor, Homestake Mineral Development Company, personal communication, 1989.)

Norwin Geological Ltd. did four exploration programs for Little July Resources Corp. on the Little July Falls property, 22 km northeast of the town of Pickle Lake. The first program, starting late in May, included prospecting, a humus geochemical survey and 18 line-kilometres of gradient array IP survey. The second program exposed, by mechanical trenching and hydraulic stripping, the "Main Showing" (Little July Falls gold occurrence) and three areas where the prospecting and IP had indicated mineralization. The third program consisted of six diamond-drill holes that totalled 939.7 m and tested the strike and downdip extensions of the main showing and an IP anomaly. A fill-in humus geochemical sampling program was also completed at the time. The fourth program, completed in October, was the trenching of an area outlined by the humus geochemical surveys. (J. McAuley and S. Winter, Norwin Geological Ltd., personal communication, 1989.)

Geocanex Ltd. continued exploration on the Power Explorations Inc. and Ravenroc Resources Ltd. joint venture Opapimiskan Lake property located to the north of the Musselwhite Grubstake property. A 12-hole, 1468.2 m diamond-drilling program further delineated gold mineralization in iron formation in an anticlinal structure on trend with East Bay zones on the Musselwhite Grubstake property. (H. Hodge, Geocanex Ltd., personal communication, 1989.)

Geocanex Ltd. continued exploration on the Power Explorations Inc. and Guinness Gold Resources Ltd. Randall Lake property. A 24-hole, 2450.6 m diamond-drilling program was conducted to define and delineate gold mineralization discovered in 1988. The gold mineralization occurs over a 2130 m strike length within highly sheared and altered metavolcanic and metasedimentary rocks within or in close proximity to the North Caribou River fault. Some of the gold mineralization occurs in iron formation. (H. Hodge, Geocanex Ltd., personal communication, 1989.)

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM

In 1989, 11 Geological Data Inventory Folios (GDIFs) were completed for areas in the Patricia Mining Division, and there are an additional three folios in progress. None of these have been published, but manuscript copies are available through the Resident Geologist's office in Sioux Lookout (Table 4.4).

Completed GDIFs from this year cover two main areas: the entire North Caribou belt and the Savant Lake area. For the remainder of 1989 and the beginning of 1990, emphasis was on the remaining GDIFs in the Savant Lake area.

The GDIF program has been funded by the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. This year is the final year of the program. Approximately 70 percent of the active exploration areas within the Sioux Lookout Resident Geologist's District have been covered by this program.

TABLE 4.4. LIST OF GEOLOGICAL DATA INVENTORY FOLIOS.

AREA	NTS AREA	GDIF NO.
ACHAPI LAKE	52P/04NE	212
AKOW LAKE	53B/16SW	IN PRESS
ARMIT LAKE	52J/07NW	IN PROGRESS
ATIKOKIWAM LAKE	52P/04NW	211
AUGUST LAKE	52P/04SE	216
BAGGY LAKE	520/12NE	362
BECKINGTON LAKE	52J/02NE	355
BELL LAKE	52G/15SW	438
CALEY LAKE	520/07SE	326
CARON LAKE	520/01SE	214
COLLISHAW LAKE	52P/12NW	430
COUCHEEMOSKOG LAKE	520/08SE	276
DONA LAKE	520/08NE	279 (UPDATED/IN PRESS)
DRUM LAKE	520/03NE	337
DUFFELL LAKE	520/02NW	338
ECHO TOWNSHIP	52F/16SW	318
ERICHSON LAKE	53B/15NE	IN PRESS
EVANS LAKE	52J/07SE	IN PRESS
FIRST LOON LAKE	52P/12SW	431
FORESTER LAKE	53B/08NE	IN PRESS
FOURBAY LAKE	52J/02SW	348
FRY LAKE	520/03NW	373
GREBE LAKE & MCCUBBIN TP.	52J/07NE	IN PROGRESS
GREENBUSH LAKE	52J/16NE	218
HOUGHTON LAKE	52J/07SW	IN PROGRESS
JOHNSTON BAY	520/03SE	374
KAPKICHI LAKE	520/08NW	277
KARL LAKE	53B/09SE	IN PRESS
KAWASHE LAKE	520/06SE	324
KEEYASK LAKE	53B/14NE	IN PRESS
LITTLE OCHIG LAKE	520/08SW	278
LOWRY LAKE	52P/04SW	215
MATAPESATAKUN BAY	520/02NE	339
MCAREE TOWNSHIP	52F/16SW	219
MCVICAR LAKE	520/11SW	365
MEEN LAKE	520/06NW	371
NABEMAKOSEKA LAKE	520/06SW	372
NEAWAGANK LAKE	53A/05NW	IN PRESS
NORTH CARIBOU LAKE	53B/15SE	IN PRESS
OSNABURGH LAKE	520/01NE	210
PASHKOKOGAN LAKE	52J/16NW	217
PENASSI LAKE	52G/14NE	465
PONSFORD LAKE	520/09SW	274
PRESS LAKE	52G/14SW	455
QUEST LAKE	52G/15NE	384
RANDALL LAKE	520/01SW	213
SADDLE LAKE	520/11NW	363
SEESEEP LAKE	53B/15NW	IN PRESS
SHARRON LAKE	52J/04NE	481
SIXMILE LAKE	52G/15NW	328
SKINNER LAKE	53B/09NW	IN PRESS
SMOCK LAKE	52G/13NE	319
SQUAW LAKE	52J/02SE	327
STOUGHTON LAKE	520/12SE	364
TARP LAKE	520/09SE	275
VALORA LAKE	52G/14SE	439
WRIGHT LAKE	520/07SW	325
ZARN LAKE	52J/04SE	475
ZEEMEL LAKE	53B/09SW	IN PRESS

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Sioux Lookout Resident Geologist's office is presently staffed by D.A. Janes, Resident Geologist and G.W. Seim, Staff Geologist. M. Roy is the Geological Secretary and C. Procter is the Geological Data Technician. During the 1989 field season, W. Feaver assisted G.W. Seim in the field. K. Carroll assisted D.A. Janes in office and field programs.

C. Proctor continued with the Geological Data Inventory Folio Program (GDIF), described previously in the report. M. Roy completed conversion of the assessment files for the Sioux Lookout office into a format compatible with the published microfiche system. This conversion has been made necessary by the fact that the Sioux Lookout office is one of a number of offices in Ontario that have had the assessment files completely microfiched. Since the microfiche program has been terminated, it is necessary to convert incoming information to a compatible format for uniformity with the rest of the assessment files. M. Roy assists C. Proctor in the production and update of the GDIFs.

G.W. Seim continued a property evaluation program for the Central Uchi and North Caribou metavolcanic belts. A summer satellite office in Pickle Lake was staffed on a part-time basis as a result of this study. The high levels of exploration activity have resulted in many new discoveries, many of which can only be accessed by aircraft. This was the second year of this program, which should be completed in 1990.

D.A. Janes continued the evaluation of the mineral deposits in the Wabigoon Subprovince; in particular, the Sturgeon Lake and Savant Lake areas. A visit was made to the Big Trout Lake property of IPCO to assess the potential of this and other properties in the area. The Resident Geologist has been occupied with computerization

TABLE 4.5. PROPERTY EXAMINATIONS IN 1989.

1. Camreco Inc.'s Goldlund Mine Property
2. Moneta-Porcupine's Vermilion Lake Gold Occurrence
3. Burnthut Island Gold Occurrence
4. Neepawa Island Gold Occurrence
5. Pike Lake Gabbro-Copper Occurrence
6. Darkwater Group, F-Group, Mattabi Mine Properties
7. King Bay Gold Deposit
8. Rainbow Island Gold Occurrence
9. St. Anthony Gold Mine Property
10. Sabin Base Metal Occurrence
11. Houghton Creek Gold Occurrence
12. O.G.S. Synoptic Mapping Project
13. O.G.S. Caron Lake Mapping Project, Greenbush Lake Section
14. Ontario Gold Joint Venture's Misehkow River Gold Prospect
15. O.G.S. Caron Lake Mapping Project, Osnaburgh Lake Section
16. Dona Lake Mine, Underground
17. Lac Minerals Ltd.'s Hasaga Deposits
18. Ontario Gold Joint Venture's South Dunlop Lake Gold Occurrence
19. Ontario Gold Joint Venture's Dempster Lake Gold Occurrences
20. Goldhunter Resources Ltd.'s Diamond Drill Camp
21. Bond Gold Canada Inc.'s Golden Patricia Mine, Underground and Surface
22. Flicka Gold Occurrence
23. UMEX Inc.'s Fry Lake Diamond Drill Core
24. Sanderson Gold Polymetallic Occurrences
25. Loon Molybdenum Occurrence
26. Bond Gold Canada Inc.'s Cooper Lake Diamond Drill Camp
27. Noramco Explorations Inc.'s Central Patricia Property (multiple visits)
28. Noramco Explorations Inc.'s Pickle Crow Property
29. Gallant Gold Mines Ltd.'s Crowshore Patricia Property
30. July Resources Corp.'s Little July Falls Gold Occurrence
31. Diamond Drill Core from Minnova Inc.'s Firstloon Lake Property
32. Musselwhite Grubstake East Bay Development Project
33. Seeseep Lake Gold Occurrence
34. Eyapamikama Lake Unconformity
35. Ontario Gold Joint Venture's Arseno Lake Base Metal Prospect
36. McGruer Lake Gold Occurrence
37. International Platinum Corporation's Nemeigusabins Lake Project

and geological data base committees active within the Ministry of Northern Development and Mines.

During the summer field season, all three Ontario Geological Survey parties active in the district were visited at least twice. Initial orientation visits were given to Ontario Geological Survey (OGS) staff and exploration staff of several companies active in the area.

G.W. Seim, assisted by other staff, conducted a 21-hour introductory prospecting course in Sioux Lookout over a six-week period. D.A. Janes gave a lecture in the Ignace District on the glacial history of the Sandbar Provincial Park area. This lecture was part of a "week-end events" program in the park and was designed for tourists and local campers.

PROPERTY EXAMINATIONS

Table 4.5 lists the property examinations that took place during 1989.

LAC MINERAL'S HASAGA DEPOSIT

Introduction

On June 14, 1989, the second author visited Lac Minerals Ltd.'s Hasaga property on Bancroft Lake. Past reports, in the assessment files, at the Sioux Lookout Resident Geologist's office, indicate that there are at least eight zones of gold mineralization on the property. The second author examined the surface exposures of the "A" deposit and the "C" deposit. A Hasaga Gold Mines Ltd. report, from 1954, estimates the tonnage of these two zones as follows:

"A" Deposit; 149000 tons grading 0.198 ounce gold per ton to a depth of 360 feet

"C" Deposit; 49780 tons grading 0.148 ounce gold per ton to a depth of 275 feet

(Sioux Lookout Resident Geologists office, Assessment Files, file # 52 O/07 SE - 0014)

Location and Access

Lac Minerals Ltd.'s Hasaga property is approximately 34 km southwest of the town of Pickle Lake (Figure 4.3). The property straddles the boundary of the Caley Lake G-Plan and the Matapesatakun Bay G-Plan and is south of Bancroft Lake (locally known as Ben Lake).

Bancroft Lake is accessible by small float-equipped aircraft during the spring, summer and fall and by ski-equipped aircraft during the winter. The shallow lake limits aircraft size under ice-free conditions. Lac Minerals Ltd. has an old drill camp at the southwest end of Bancroft Lake. Drilling roads lead south of the camp to the deposit area.

Exploration History

In August 1953, B. Ohman, a well-known prospector in the Pickle Lake area, discovered interesting mineralization south of Bancroft Lake. Ohman submitted some samples to Hasaga Gold Mines Ltd. for assay and the results were interesting enough to prompt a property visit from their geologists. Channel and chip samples, taken during this visit, returned values of $6.58 over 31.25 feet and $25.85 over 8.5 feet (gold at $34.42 per ounce). Hasaga Gold Mines Limited subsequently optioned 45 claims from Ohman and his backers, the Koval family of Pickle Lake, in September of 1953.

Between September and December 1953, Hasaga Gold Mines Limited carried out line cutting, trenching and diamond drilling on the optioned claims. Additional claims, surrounding the optioned claims, were staked for protection. The diamond drilling totalled 7391 feet. Work resumed on the property in May 1954 and continued to December 1954, at which time operations were suspended. During this period, Hasaga's exploration crew located at least five new showings on the property and completed 13580 feet of diamond drilling. The tonnage and grade figures, quoted above, were calculated based upon the result of the 1953 and 1954 exploration programs.

Although a few memos, concerning the property, are present in the assessment files, little work was conducted on the property between 1955 and 1975. However, during that time, Little Long Lac Gold Mines Ltd. acquired the Hasaga property.

In 1974, Little Long Lac Gold Mines Ltd. decided to re-examine the Hasaga property. A new grid was cut over the claim group and geological, ground magnetic, VLF-EM and IP surveys were carried out. In 1987, Lac Minerals Ltd. conducted a major diamond-drilling program on the property.

Regional Geology

Recent Ontario Geological Survey mapping, in the Bancroft Lake area, was carried out by Stott and Wilson (1986a, 1986b).

Four main rock types underlie the Bancroft Lake area. In the north is a 1 to 2 km thick succession of mafic

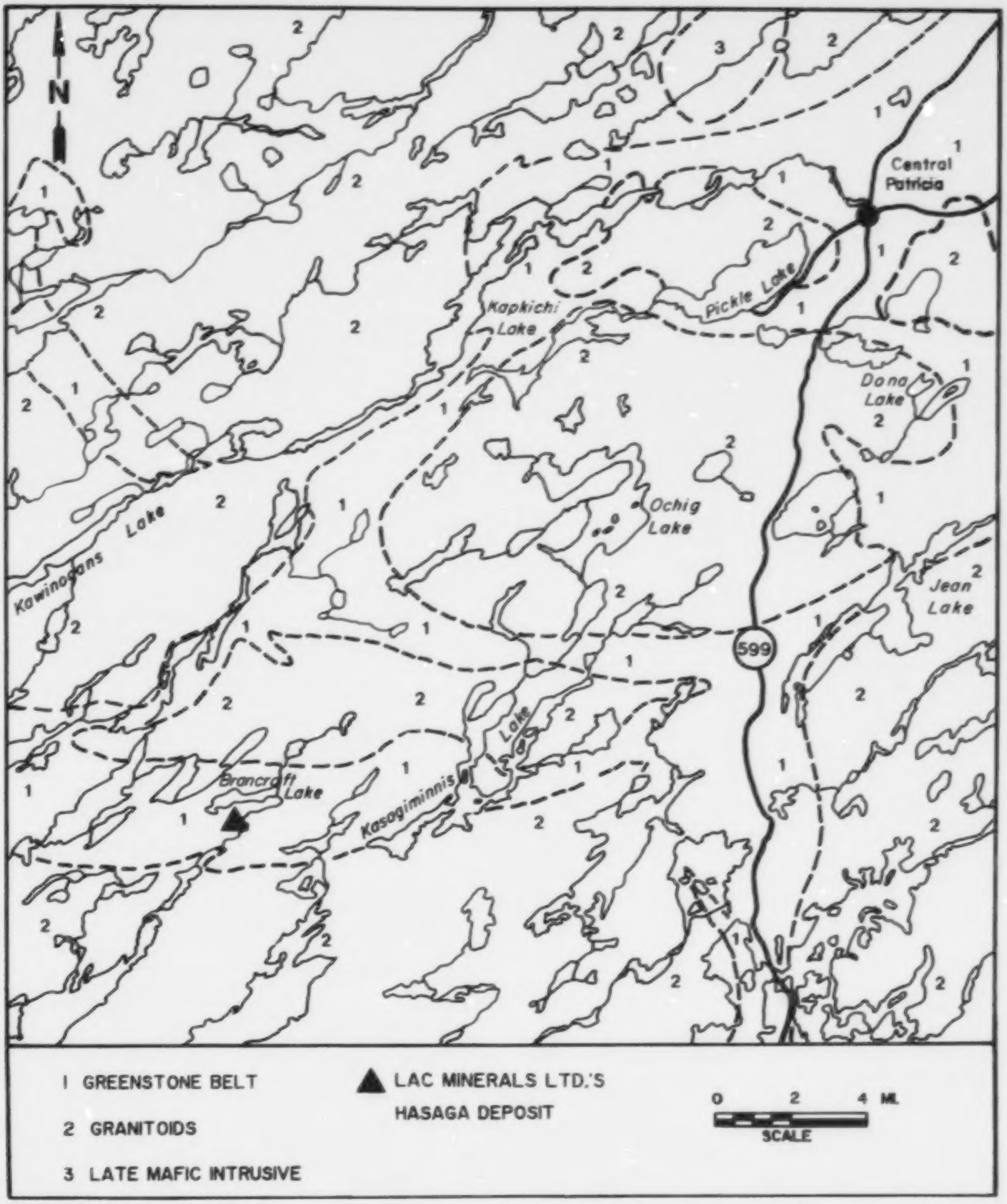

N
Central Patricia
Pickle Lake
Kapkichi Lake
Dona Lake
Ochig Lake
Jean Lake
Kawinogans Lake
599
Lake
Brancroft Lake
Kasagiminnis
1 GREENSTONE BELT
2 GRANITOIDS
3 LATE MAFIC INTRUSIVE
LAC MINERALS LTD.'S HASAGA DEPOSIT
0 2 4 MI.
SCALE

Figure 4.3. Location map for Lac Minerals Ltd.'s Hasaga deposit.

metavolcanics. Sage and Breaks (1982) tentatively interpreted deformed pillow structures within the succession as south facing. To the south of the mafic metavolcanic succession is a 1 to 3 km thick unit of predominantly intermediate to felsic metatuffs. The gold mineralization on the Hasaga property is hosted by the intermediate to felsic metatuffs. A small (0.5 by 1 km), gabbroic plug intruded along the contact of the mafic metavolcanics with the intermediate to felsic metatuffs. An east-trending shear zone cuts this contact and the gabbroic plug.

South of the intermediate to felsic metatuffs is a 0.5 km thick succession of mafic metavolcanics. Farther to the south are metasediments. The metavolcanics and metasediments trend east to east-northeast.

Property Examination

Examination of the assessment files in the Sioux Lookout Resident Geologist's office suggests that all of the known gold occurrences, on the Hasaga property, occur within the intermediate to felsic metatuff unit. The "A" and "C" deposits are definitely hosted by the metatuff unit.

The "A" deposit outcrops between 2+00 E/1+00 N and 1+00 W/1+00 S on the Lac Minerals Ltd. grid, (measured in feet). A series of old trenches also exposes the mineralization. Thinly laminated metatuffs are located to the north of the mineralization. Mafic minerals compose 10 to 25 percent of the laminae in the metatuff. The second author estimates the metatuffs to be dacitic in composition. The bedding and the foliation are subparallel, striking 070° and dipping 76°S. A prominent lineation on an azimuth of 114° plunges 72°. Fine-grained felsic dikes, striking 080° to 090°, cut the metatuffs. These felsic dikes contain conjugate, quartz-tourmaline-filled tension gashes that trend 110° and 170°.

The mineralized unit is a well-sheared, siliceous, sericitic schist. The contact between the dacitic metatuffs and sericitic schist is gradational over a couple of metres. The schistosity strikes 082° and dips 86°S. The sericitic schist contains 1 to 5 percent very fine, disseminated pyrite and up to 1 percent disseminated tourmaline crystals and clusters. The tourmaline crystals define a mineral lineation on an azimuth of 100° plunging 51°. The sericitic schist is approximately 6 m in width and has a strike length of approximately 100 m. The sericitic schist unit appears to be lenticular in shape.

A 1 to 2 m wide layer of mafic metatuff is situated immediately south of the mineralized sericitic schist.

A lapilli metatuff is found south of the mafic metatuff. The matrix of the lapilli metatuff is intermediate in composition. The lapilli are intermediate to felsic in composition and are very stretched (length to thickness ratio greater than 10:1). The lapilli metatuff strikes 070° and dips 80°S. Narrow blue-grey quartz veins (0.5 to 3 cm) cut the lapilli metatuff and have a strike and dip of 075/70S.

The "C" deposit is located approximately 400 m west-southwest of the "A" deposit. The mineralized zone is exposed in a series of trenches between lines 10+50 W and 13+50 W, 600 to 800 feet south of the baseline.

The "C" deposit is in approximately the same stratigraphic position as the "A" deposit. Dacitic metatuffs host the "C" deposit mineralization and a lapilli tuff unit is found to the south. The mineralized zone is not as well defined as it is at the "A" deposit. Rather, the mineralized zone consists of 1 to 10 percent disseminated pyrite in weakly silicified, dacitic metatuff. Only locally is the silicification strong enough to make the rock appear bleached and sericitic. The width of the mineralization is variable between 3 and 5 m, and it occurs over a strike length of approximately 100 m. The extent to which the mineralized section carries gold is not known to the second author.

Bedding and shearing are subparallel at the "C" deposit and strike between 090° and 070°, and dip 89°S to 90°. South of the mineralized zone, narrow, blue-grey, quartz stringers strike 045° through the lapilli tuff.

Discussion

The gold mineralization at the Hasaga property is apparently related to shear zones that occur at a very low angle ($< 10°$) to the bedding. The hydrothermal fluids that deposited the mineralization also silicified and sericitized the shear zones. Tourmaline occurs both in the mineralized zones and in tension fractures in the felsic dikes cutting the area. Alignment of the tourmaline crystals indicates strain during and/or after the mineralizing events. An outcrop located 10 m south of the baseline on line 6+00 W, exposes S-type, parasitic folds in intermediate to felsic metatuffs. Blue-grey quartz stringers, in the same outcrop, were folded into "Z" shapes. These two observations suggest that the shearing was left handed and that some deformation happened after the hydrothermal event.

THE ONTARIO GOLD JOINT VENTURE MISEHKOW RIVER GOLD PROSPECT

Introduction

In September of 1988, Northern Dynasty Explorations Ltd., Westfield Minerals Ltd. and Newfields Minerals Inc. announced promising intersections of gold mineralization from two diamond-drill holes on their joint-ventured Misehkow River property (George Cross News Letter, No. 188, Sept. 29, 1988). By February of 1989, 12 holes had been completed on the property. Seven holes, including the initial two, intersected significant gold mineralization (George Cross News Letter, No. 26, Feb. 7, 1989). The diamond drilling encountered the gold mineralization over a 1.4 mile strike length and to depths of 500 feet (Vancouver Stockwatch, July 19, 1989).

Location and Access

The Misehkow River gold prospect is located in the Achapi Lake area, approximately 56 km southeast of Pickle Lake (Figure 4.4). The mineralized zone strikes northeast, and is located 0.5 to 1 km north of the Misehkow River.

The Misehkow River widens into a long lake south of the mineralized zone. Only this section of the river is suitable for float-equipped aircraft. The area is not road accessible.

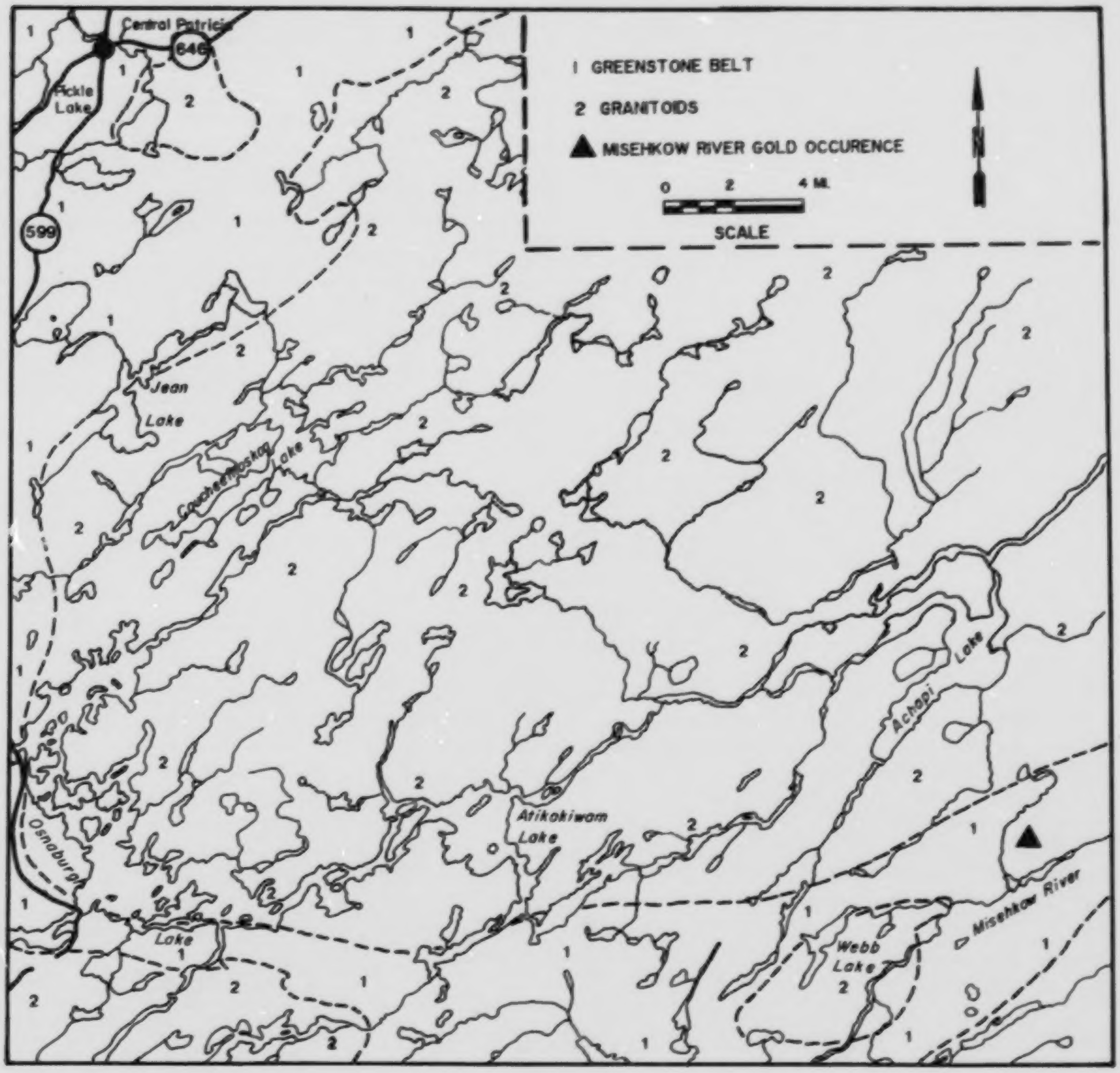

1 GREENSTONE BELT
2 GRANITOIDS
▲ MISEHKOW RIVER GOLD OCCURENCE
0 2 4 MI.
SCALE
N
Central Patricia
Pickle Lake
646
599
Jean Lake
Cauchemoska Lake
Osnaburgh Lake
Atikokiwam Lake
Achapi Lake
Webb Lake
Misehkow River

Figure 4.4. Location map for the Misehkow River gold occurrence.

Exploration History

In 1968, Sturdy Mines Ltd. drilled the Misehkow River iron deposit. The deposit is located under the Misehkow River.

Hudson Bay Exploration and Development Co. Ltd. flew an airborne EM survey, over most of the Achapi Lake area, in 1971, and followed up with two diamond-drill holes, southwest of the Misehkow River iron deposit.

In 1977 and 1978, The Algoma Steel Corp. Limited conducted further drilling on the iron deposit. The Misehkow River iron deposit has an estimated reserve of 64 555 000 tonnes (t), grading 21 percent Fe, to a depth of 150 m (Sage and Breaks 1982).

The discovery of the Dona Lake and Golden Patricia gold deposits in 1984 and 1985 sparked a flurry of exploration activity in the Central Uchi greenstone belt. Much of the greenstone in the Achapi Lake area was staked between 1984 and 1986 and is undergoing active exploration.

Regional Geology

Sage and Breaks (1982) discussed the regional geology of the Misehkow River area.

The Misehkow River gold prospect occurs in the eastern part of the Central Uchi greenstone belt. The belt is interpreted to be a large synclinorium, the axis of which strikes east-northeast. In order of abundance, the Misehkow River area is underlain by mafic to intermediate metavolcanics, felsic metavolcanics, clastic metasediments and iron formation. The main iron formation horizon, a prime exploration target, is traced by the regional airborne magnetic survey for over 30 km.

Both felsic and mafic intrusive rocks cut the metavolcanics and the metasediments. The Webb Lake stock, a syntectonic to late tectonic trondhjemite, found west of the Misehkow River gold prospect, is the main intrusive body in this part of the Central Uchi greenstone belt. Other intrusive rocks include quartz and feldspar porphyries, diorites and gabbros.

Property Examination

The second author is indebted to G. Gorzynski and D. Elsby, geologists with Northern Dynasty Explorations Ltd., for their assistance during the property examination. The second author's geological understanding of the Misehkow River gold prospect reflects, for the most part, their interpretation of the geology at that time. Any errors or omissions are the responsibility of the second author.

Mafic metavolcanics underlie most of the Ontario Gold Joint Venture Misehkow River property. The mafic metavolcanic rocks consist of massive and pillowed lavas and minor tuffaceous beds. An iron formation horizon and several interflow metasedimentary horizons are interlayered with the mafic metavolcanics. The mafic metavolcanics and the metasediments strike east and dip steeply north across most of the property. Variably sheared quartz-augen schists, striking east-northeast, appear to cut the mafic metavolcanics and the metasediments. The quartz-augen schists contain up to 10 percent of 1 to 3 mm blue quartz augen in a matrix composed of quartz, iron-rich amphibole and sericite schist. A large gabbroic intrusive outcrops at the north end of the property.

A schistosity and two cleavages are observed in the Misehkow River area. The three fabrics indicate at least three phases of deformation. The quartz-augen-quartz-iron amphibole-sericite schists (quartz-augen schists) exhibit the schistosity and cleavages. The quartz-augen schists occur along shear and/or fault planes (S_1), which are the result of an early period of deformation (D_1). Northern Dynasty Explorations Ltd. believes that the gabbroic body occurring at the north end of the property intruded between the first (D_1) and second (D_2) deformational event and had a significant effect on the post D_2 deformation geometry. D_2 caused a schistosity (S_2) that crosscuts stratigraphy, striking 040° to 045° and dipping 70° to 80°NW. D_3 caused an evenly spaced slaty cleavage (S_3) striking 060° to 065° and dipping 85°N to vertical. Sigmoidal deflection of the S_2 into the S_3 plane indicates right-handed movement along the cleavage planes. Bedding (S_0) is subparallel to S_3. D_4, a broad warping of the greenstone belt, caused a vertical, north-trending cleavage (S_4).

At the time of the property examination, there were two known zones of gold mineralization on the Ontario Gold Joint Venture's Misehkow River property. Both zones are associated with quartz-augen schists. Along the 1.4 km strike length of the main zone, the gold mineralization occurs, for the most part, with sulphide replacement of magnetite and grunerite in iron formation, where it is enveloped by a unit of quartz-augen schist. The second zone, named the Wajax zone, occurs entirely within a 6 to 20 m wide quartz-augen schist. Here the gold mineralization is associated with pyrite and arsenopyrite that is contained within the schist. Assays of channel samples from this zone range up to 0.035 ounce gold per ton.

The quartz-augen schist of the main zone does not outcrop except along a cliff exposure near the western end of the property. Most information about the main zone comes from widely spaced (average 200 m) diamond-drill holes. The rock sequence varies between drill holes, but the general sequence from north to south is mafic metavolcanics, followed by a unit of quartz-augen schist enveloping an iron formation horizon, then iron formation followed by mafic metavolcanics. To the west, the drill holes intersect the iron formation horizon north of the altered quartz-augen schists, and to the east, the drill holes intersect the iron formation horizon south of the quartz-augen schists. The second author initially interpreted the quartz-augen schist unit as a shear transposed quartz porphyry dike swarm. D. Elsby of Northern Dynasty Explorations Ltd. has provided evidence that the quartz-augen schist is a D_1 shear and/or fault zone which was silicified and mineralized during D_1 and D_2. The silicified and mineralized shear and/or fault zone was later selectively sericitized and mylonitized during D_3. Northern Dynasty Explorations Ltd.'s evidence comes from thin section examination of the schist, and from observations made logging core drilled after the second author's visit. The observations include an increasing intensity of silicification in the mafic metavolcanics surrounding the schist unit and the presence of quartz augen in the mafic metavolcanics that increase in abundance towards the schist. Northern Dynasty Explorations Ltd. has also noted that the diamond drilling and magnetic survey indicate the iron formation horizon is highly contorted but continuous where it is enveloped by the quartz-augen schist unit. (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.)

Gold mineralization along the main zone occurs in all three rock types. Low assay values (0.01 to 0.03 ounce gold per ton) are associated with quartz ± carbonate ± pyrite veins, stringers and disseminations in the quartz-augen schists in most holes. Northern Dynasty Explorations Ltd. informed the second author that diamond drilling done after the property examination intersected gold mineralization in quartz-augen schist that assayed 0.089 ounce gold per ton over 4 feet and 0.06 ounce gold per ton over 14 feet. (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.) In hole M-88-11, the gold mineralization occurs in a zone of quartz-carbonate-pyrite stringers in mafic metavolcanics on the south side of the quartz-augen schist unit. The main interest, however, centred on the gold mineralization associated with the iron formation horizon where it is enveloped by the quartz-augen schist.

The iron formation horizon is not sulphide replaced and yields only low anomalous gold values west of where it is enveloped by the quartz-augen schist. The iron formation horizon is enveloped by the quartz-augen schist unit over an east-west length of approximately 1000 m. Here pyrrhotite occurs as a replacement of magnetite and possibly grunerite and as disseminations in the quartz-augen schist. Where the pyrrhotite occurs in these habits, the iron formation horizon and the quartz-augen schist are gold bearing. Northern Dynasty Explorations Ltd. have noted that the gold mineralization "occurs primarily in the hinge regions of macroscopic F_1 and F_2 folds". (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.)

To the east, the iron formation horizon is located to the south of the quartz-augen schists and had not been tested by drilling at the time of the property examination.

Different alteration processes affected the various rock types along the length of the main zone. Insufficient observations were made during this property examination to speculate on the timing and significance of each alteration type. Both grunerite and pyrrhotite replace magnetite in the iron formation horizon. The quartz-augen schists are products of shearing and silicification. They are only sericitic within and surrounding discrete S_2 shear zones. (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.) The mafic metavolcanics are locally silicified and weakly carbonatized. The iron formation horizon and the quartz-augen schists are weakly carbonatized in the discrete S_2 shear zones. Only in one of the more easterly holes does iron carbonate occur in the quartz-augen schist.

GOLD OCCURRENCES IN THE DEMPSTER LAKE AREA

Introduction

In 1984, Northern Dynasty Explorations Ltd., operator of the Ontario Gold Joint Venture's Dempster Lake property, began prospecting the area around the southern end of the Graniteboss Lake intrusion. Their geologists located several gold showings and areas geochemically anomalous in gold. Northern Dynasty Explorations Ltd. and Newfields Minerals Inc. then staked 88 claims to cover their finds. Later on, Northern Dynasty Explorations Ltd. expanded the claim group to 184 claims.

During the property visit, the author examined the gold showings around the north end of Dempster Lake and an occurrence at the southeast end of a small lake 2 km south of the west end of Mousetrap Lake. This occurrence is known as the South Dunlop Lake occurrence.

Location and Access

Dempster Lake is located approximately 55 km southwest of the town of Pickle Lake (*see* Figure 4.6). Dempster Lake and Mousetrap Lake, which is located 4 km to the west of Dempster Lake, are both suitable for float-equipped aircraft. In the winter, a seasonal road along the Ear Falls to Pickle Lake power line allows access to the claim group.

Exploration History

The first indication of gold mineralization in the Dempster Lake area is an assay reported by Harding (1936). A grab sample from an east-striking mineralized quartz-porphyry dike south of Dempster Lake, assayed 0.02 ounce gold per ton (approximately 700 ppb).

During the 1970s, several exploration companies searched for base metals in the Dempster Lake area. Cochenour Willans Gold Mines Ltd. and Cominco Inc. drill tested electromagnetic anomalies in the west and northwest parts of the present Ontario Gold Joint Venture property (Assessment Files, Sioux Lookout Resident Geologist's office).

In 1984, Northern Dynasty Explorations Ltd. started prospecting and staking in the Dempster Lake area. After entering into a joint venture agreement with Newfields Minerals Inc. and Westfield Minerals Ltd., Northern Dynasty Explorations Ltd. conducted exploration programs including line cutting, geological mapping, geochemical soil sampling, geophysics, surface trenching and diamond drilling. The property has been dormant since 1988.

Regional Geology

Stott and Wilson (1986a, 1986b) did synoptic 1:50000 scale mapping of the Meen Lake–Dempster Lake greenstone belt in 1984.

The Dempster Lake area is underlain by the dominantly metavolcanic rock of the Dempster Lake cycle to the north, and by the Billett Lake sedimentary belt to the south. The Dempster Lake gabbro intruded along the contact between the Dempster Lake cycle and the Billett Lake metasedimentary belt, in the western part of the area. This gabbro intrusion crosscuts the Dempster Lake cycle in the eastern part of the area. All three units wrap around the southern part of the Graniteboss Lake stock. The Graniteboss Lake stock is an unmetamorphosed granodiorite to monzogranite body.

The Dempster Lake cycle consists of a south-facing, bimodal metavolcanic succession. Mafic metavolcanics outcrop to the north and are mainly pillowed and massive flows. Lithic tuffs outcrop west of Dempster Lake. Minor iron formation and metasedimentary interbeds occur within the mafic metavolcanics. Intermediate to felsic metavolcanics lie to the south of the mafic metavolcanics. The dominant rock types comprising the intermediate to felsic metavolcanics are tuffs, crystal tuffs and fine- to coarse-grained pyroclastics. Occasional interbeds of iron formation and debris flow occur within the intermediate to felsic metavolcanics.

Stott and Wilson (1986a, 1986b) mapped a wide (greater than 1500 m) zone of strong to intense deformation along the contact of the Billett Lake metasediments with the Dempster Lake cycle, south of Mousetrap Lake. The deformation zone strikes parallel to this contact, and continues into the Dempster Lake gabbro, south of Dempster Lake. On the Ontario Gold Joint Venture property, the deformation zone is narrower, but still averages more than 300 m in width.

Stott and Wilson (1986a) recognized four phases of deformation in the Meen Lake–Dempster Lake greenstone belt. Each phase induced relatively distinct mineral lineations on the rock they affected. Stott and Wilson (1986a) suggested that gold mineralization events were synchronous with the first, second and fourth phases of deformation. More recent examinations of gold occurrences in the Meen Lake–Dempster Lake greenstone belt by the second author leads him to believe that the major gold mineralization event took place synchronous with D_2.

Property Examination

During the week of July 24 to July 28, 1989, the second author visited three gold occurrences not previously documented in the Sioux Lookout Resident Geologist's files. These are reported separately with a discussion to follow.

The second author also visited Goldhunter Exploration Inc.'s diamond-drill camp northwest of Dempster Lake. Goldhunter Exploration Inc. had just completed a drill program the week previous and had left the camp. The second author made a cursory examination of Goldhunter Exploration Inc.'s drill core. (In March of 1989, Goldhunter Exploration Inc. announced a six-foot core intersection that averaged 0.66 ounce gold per ton (The Northern Miner, Mar. 27, 1989, p.16).)

Sudbury Point Gold Occurrence

Sudbury Point, a name used by Northern Dynasty Explorations Ltd., is a small point of land on the northwest shore of the north part of Dempster Lake (Figure 4.5, No. 1). Northern Dynasty Explorations Ltd. found gold mineralization in quartz-tourmaline veins at Sudbury Point in 1984. They have surface trenched and channel sampled the outcrop on the point and drilled three diamond-drill holes to test the showing.

Three rock types are exposed on Sudbury Point, one of which is a felsic metavolcanic. The other two are intrusive dikes; quartz-feldspar porphyry dikes and intermediate dikes with chlorite porphyroblasts. The felsic metavolcanic may have once been a lapilli tuff, but alteration and deformation have all but destroyed the original textures. The resultant rock is a very fine grained sericitic, weakly chloritized, carbonitized schist that weathers light grey to buff. It contains many quartz and quartz-tourmaline veins aligned parallel to the S_2 shear direction.

Two schistosities and one fracture cleavage are recognized at Sudbury Point and can easily be observed in the felsic metavolcanics. The two schistosities, S_1 and S_2, strike 080° (dipping 85°S) and 060° to 070° (dipping 85°N), respectively. S_1 does not penetrate the dikes. S_2 penetrates the intermediate dikes as a cleavage. It does not penetrate the quartz-tourmaline veins. S_3 is a fracture cleavage that strikes 150° and dips 70°NE. It penetrates both the intermediate and quartz-feldspar porphyry dikes.

Dikes of quartz-feldspar porphyry make up 50 percent of rock exposure on Sudbury Point. They are up to 3 m thick and trend 070° to 080° subparallel to the S_1 schistosity. The quartz-feldspar porphyry is composed of 60 to 70 percent cream-coloured, round, 1 to 3 mm feldspar phenocrysts and less than 10 percent quartz phenocrysts of the same size and shape. The groundmass is composed mainly of very fine grained red feldspar crystals. Some of the dikes contain chlorite spots. The dikes contain many (up to 10 percent) quartz-tourmaline veins. The veins filled tension gashes in the dikes. Strike measurements on 100 of the tension gashes show two ranges in strike direction, 300° to 317° and 336° to 010°. The tension gashes do not appear to be a conjugate set. The dikes are also penetrated by the S_3 fracture cleavage.

Four narrow (less than 1 m) intermediate dikes cross Sudbury Point. They strike 070° to 080° in the trenches, but are difficult to trace between trenches. The intermediate dikes contain up to 30 percent, 1 to 3 mm lenticular chlorite porphyroblasts in an intensely carbonitized feldspathic matrix. Iron carbonate is estimated to comprise up to 50 percent of the intermediate dikes.

The gold mineralization at Sudbury Point is associated with the quartz-tourmaline veins filling tension gashes in the quartz feldspar porphyry dikes. Some of the veins have pyritic rims. The best assay values reported by Northern Dynasty Explorations Ltd. are two grab samples that assayed 0.28 ounce gold per ton and 0.29 ounce gold per ton and a 0.5 by 1.0 m panel sample over an 89 cm wide chlorite-spotted, quartz-feldspar porphyry dike that assayed 0.56 ounce gold per ton.

North Dempster Lake Gold Occurrence

The North Dempster Lake gold occurrence is similar to the Sudbury Point gold occurrence (Figure 4.5, No. 2). The differences between the two occurrences are in the absence of the intermediate dikes and in the attitudes of the various structural elements at the North Dempster Lake gold occurrence. The gold mineralization is still associated with quartz-tourmaline veins filling tension fractures in the quartz-feldspar porphyry.

At the North Dempster Lake gold occurrence, a quartz-feldspar porphyry dike over 6 m in width cuts through the felsic metavolcanics. The dike strikes 110°, parallel to the S_2 schistosity. The S_1 schistosity, which penetrated only the felsic metavolcanics, strikes 080° and dips 60°N. Most of the quartz-tourmaline veins in the quartz-feldspar porphyry dikes trend between 000°

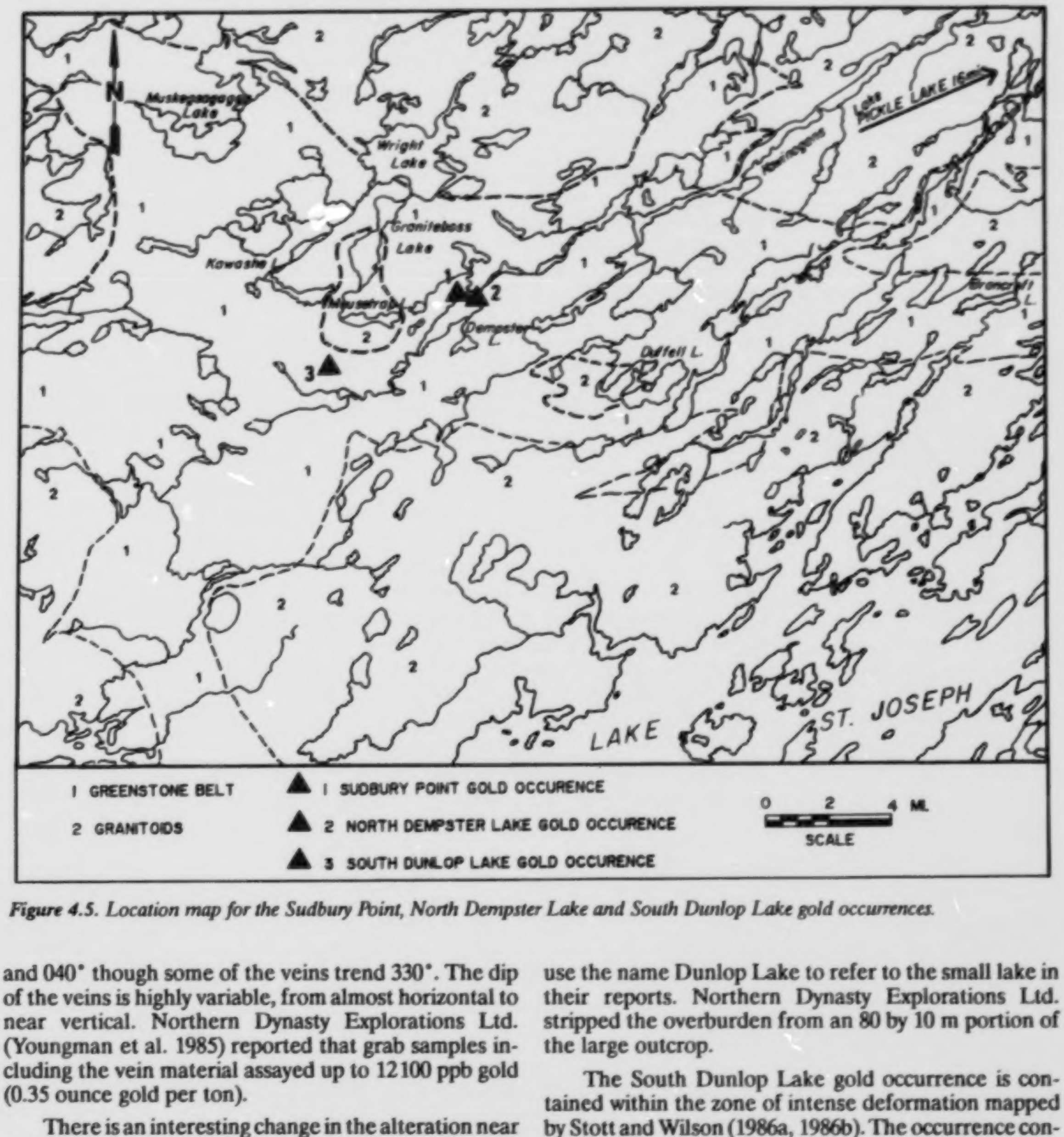

N
Muskegogagga Lake
Wright Lake
Graniteboss Lake
Kawashe
Mousetrap
Dempster L.
Duffell L.
Kawinogans Lake
PICKLE LAKE 16mls
Brancott L.
LAKE ST. JOSEPH
1 GREENSTONE BELT
2 GRANITOIDS
▲ 1 SUDBURY POINT GOLD OCCURENCE
▲ 2 NORTH DEMPSTER LAKE GOLD OCCURENCE
▲ 3 SOUTH DUNLOP LAKE GOLD OCCURENCE
0 2 4 MI.
SCALE

Figure 4.5. Location map for the Sudbury Point, North Dempster Lake and South Dunlop Lake gold occurrences.

and 040° though some of the veins trend 330°. The dip of the veins is highly variable, from almost horizontal to near vertical. Northern Dynasty Explorations Ltd. (Youngman et al. 1985) reported that grab samples including the vein material assayed up to 12100 ppb gold (0.35 ounce gold per ton).

There is an interesting change in the alteration near the North Dempster Lake gold occurrence. The intensity of the carbonitization is decreased and tourmaline crystals have developed along the S_2 schistosity planes in the felsic metavolcanics. Except for the lack of pyrite, the felsic metavolcanics are similar in appearance to the felsic metavolcanics that host the Lac Minerals Ltd. Hasaga deposit some 26 km to the east.

South Dunlop Lake Gold Occurrence

In 1984, Northern Dynasty Explorations Ltd. discovered gold mineralization in a large outcrop on the southeast shore of a small lake 2 km south of Mousetrap Lake (Figure 4.5, No. 3). Northern Dynasty Explorations Ltd. use the name Dunlop Lake to refer to the small lake in their reports. Northern Dynasty Explorations Ltd. stripped the overburden from an 80 by 10 m portion of the large outcrop.

The South Dunlop Lake gold occurrence is contained within the zone of intense deformation mapped by Stott and Wilson (1986a, 1986b). The occurrence consists of several deformed quartz-tourmaline-pyrite veins contained within a 15 m wide intensely deformed, silicified felsic metavolcanic unit. Intensely deformed mafic metavolcanics outcrop to the south of the silicified felsic metavolcanics. Intensely deformed intermediate to felsic metavolcanics outcrop to the north of the silicified felsic metavolcanics.

The second deformation event was so intense that, in the vicinity of the occurrence, primary textures and early deformation fabrics were masked. A well-developed slaty cleavage is the prominent structural feature of the rocks around the occurrence. The cleavage planes are 3 to 10 mm apart. They strike 125° and dip 83°S within the silicified felsic metavolcanics. Occasional, narrow (10 to 30 cm) fault breccia zones, that strike subparallel to the cleavage, cut the silicified felsic metavolcanics. The cleavage does not penetrate the fault breccia zones. The latest structural feature observed in the vicinity of the occurrence is a set of conjugate kink bands in the cleavage planes. The conjugate kink bands strike 000° and 090° and dip 65°W and 65°S, respectively.

The quartz-tourmaline-pyrite veins, which contain the gold at the South Dunlop Lake occurrence, trend east and dip to the north. The veins are highly contorted and are penetrated by the cleavage. They average less than 30 cm in thickness and do not extend beyond the silicified felsic metavolcanics. The veins are offset by the fault breccia zones. The apparent offset is left handed which does not conform to the ideas of Stott and Wilson (1986a, 1986b), who mapped the sense of movement within the deformation zone as right handed.

Northern Dynasty Explorations Ltd. reported that individual grab samples of the quartz-tourmaline-pyrite veins assayed up to 0.52 ounce gold per ton. They also reported that panel samples that included the silicified felsic metavolcanic and vein material returned values less than 100 ppb gold (Youngman et al. 1985).

Other interesting features that the second author noticed in the vicinity of the South Dunlop Lake gold occurrence are: narrow (1.0 cm), short (less than 3 m) east-trending quartz veins within the mafic metavolcanics; and quartz-feldspar porphyry dikes along the contact of the silicified felsic metavolcanic and the intermediate to felsic metavolcanics. The quartz-feldspar porphyry dikes do not contain veining as found at Sudbury Point, Dempster Lake.

Discussion

In addition to the three gold occurrences described above, Northern Dynasty Explorations Ltd. has discovered a few other minor gold occurrences and several zones where rock and/or soil samples are anomalous in gold within the Dempster Lake area. The minor gold occurrences are of three types. The first type includes quartz-tourmaline veins which fill tension gashes in quartz-feldspar porphyry dikes as at Sudbury Point. The second type includes swarms of quartz-tourmaline veins which fill fractures within the Graniteboss Lake stock. The third type are sulphidized sections of the iron formation horizons within the metavolcanics.

With the exception of quartz-tourmaline veins within the Graniteboss Lake stock, all the known gold occurrences of the Dempster Lake area are associated with intensely deformed metavolcanics. Those occurrences south of Mousetrap Lake are associated with the zone of deformation mapped by Stott and Wilson (1986a, 1986b).

The deformation zone strikes parallel to stratigraphy from southeast of Billett Lake, southeast to the south end of Dempster Lake. Eastward from there, the deformation zone may strike into the Dempster Lake gabbro or it may follow the Dempster Lake gabbro–Billett Lake metasedimentary belt contact (G.M. Stott, Ontario Geological Survey, personal communication, 1989). For those gold occurrences west and at the north end of Dempster Lake, the second author suggests a second and probably older deformation zone. This proposed zone follows the intermediate to felsic metavolcanics from the southwest end of Dempster Lake, north and then east for an unknown distance. This deformation zone is truncated and/or overprinted by the deformation zone mapped by Stott and Wilson (1986a, 1986b) (Figure 4.6).

SEESEEP LAKE GOLD OCCURRENCE

Introduction

Bartlett et al. (1985) reported a value of 4630 ppb gold for a sample located near the south end of the channel connecting Seeseep Lake to Eyapamikama Lake. The second author investigated the source of the reported value.

Location and Access

Seeseep Lake is located approximately 160 km north-northwest of Pickle Lake (Figure 4.7). Seeseep Lake and Eyapamikama Lake are both suitable for float-equipped aircraft.

Exploration History

Until the recent surge of exploration activity, sparked by the flow-through provisions in the Canada Income Tax Act, there was very little exploration activity in the Eyapamikama Lake area of the North Caribou Lake greenstone belt. The only recorded work in the immediate vicinity of the Seeseep Lake gold occurrence was a single X-ray diamond-drill hole drilled by Canadian Nickel Co. Ltd. in 1972.

Subsequent to the release of Map P.2834 by Bartlett et al. (1985), Power Explorations Inc. had 16 claims staked to cover the area surrounding the reported gold occurrence. The claims also covered the two sample locations to the north, for which low but anomalous gold values were reported. In 1985, a grid was cut on the claims, and magnetic and VLF-EM surveys were conducted. In 1987, a geological survey of the claims was conducted and two zones with anomalous gold mineralization were outlined.

Regional Geology

Satterly (1940) mapped the North Caribou Lake greenstone belt for the Ontario Department of Mines at a scale of 1:63360. As part of the Opapimiskan Lake Project, Bartlett et al. (1985) mapped the geology of the Eyapamikama Lake area at a scale of 1:31680. As part of the Opapimiskan Lake Project, the Ontario Geological Survey commissioned an airborne magnetic and EM survey over the North Caribou Lake greenstone belt (Figure 4.8).

The Eyapamikama Lake area is at the northwest end of the North Caribou Lake greenstone belt. The

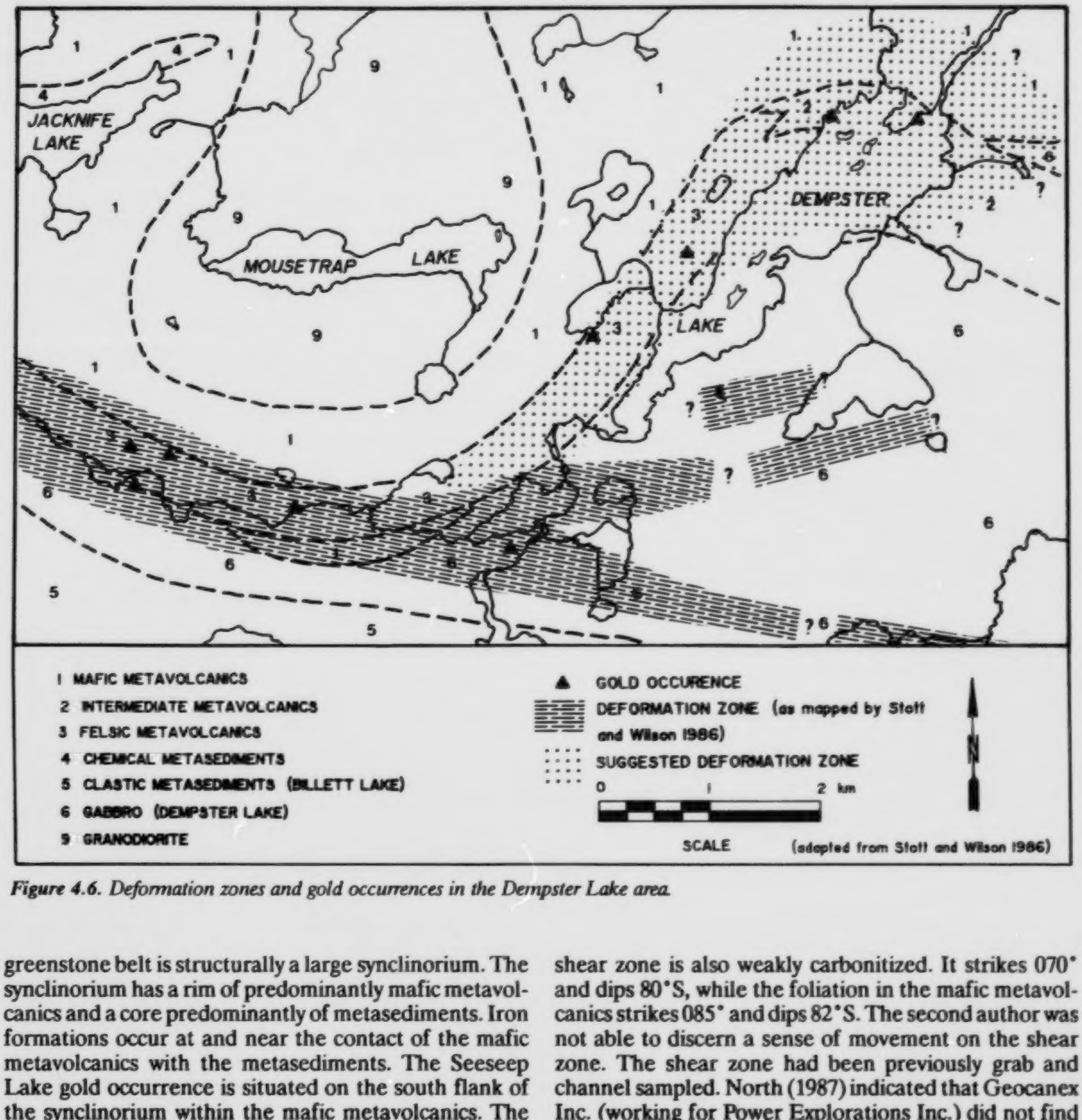

JACKNIFE LAKE
MOUSETRAP LAKE
DEMPSTER LAKE
1 MAFIC METAVOLCANICS
2 INTERMEDIATE METAVOLCANICS
3 FELSIC METAVOLCANICS
4 CHEMICAL METASEDIMENTS
5 CLASTIC METASEDIMENTS (BILLETT LAKE)
6 GABBRO (DEMPSTER LAKE)
9 GRANODIORITE
▲ GOLD OCCURENCE
▤ DEFORMATION ZONE (as mapped by Stott and Wilson 1986)
⁘ SUGGESTED DEFORMATION ZONE
0 1 2 km
SCALE
N
(adapted from Stott and Wilson 1986)

Figure 4.6. Deformation zones and gold occurrences in the Dempster Lake area.

greenstone belt is structurally a large synclinorium. The synclinorium has a rim of predominantly mafic metavolcanics and a core predominantly of metasediments. Iron formations occur at and near the contact of the mafic metavolcanics with the metasediments. The Seeseep Lake gold occurrence is situated on the south flank of the synclinorium within the mafic metavolcanics. The mafic metavolcanics strike easterly and dip almost vertically. Pillow tops indicate the rock succession becomes younger to the north. South of the mafic metavolcanics is the North Caribou Lake batholith.

Property Examination

The second author briefly examined the outcrops along the east shore of the channel between Eyapamikama Lake and Seeseep Lake and observed mafic metavolcanics as indicated by Bartlett et al. (1985). At the north end of the southernmost outcrop, the second author observed a 0.5 to 1.0 m wide shear zone cutting through mafic metavolcanics. It is weakly gossaned and contains approximately 1 percent pyrite and arsenopyrite. The shear zone is also weakly carbonitized. It strikes 070° and dips 80°S, while the foliation in the mafic metavolcanics strikes 085° and dips 82°S. The second author was not able to discern a sense of movement on the shear zone. The shear zone had been previously grab and channel sampled. North (1987) indicated that Geocanex Inc. (working for Power Explorations Inc.) did not find anomalous gold in their samples from this area.

Bartlett et al. (1985) did not map or indicate the near continuous outcrop on the west shore at the south end of the channel between Eyapamikama Lake and Seeseep Lake. Upon examination of the outcrops on the west shore, the second author found two subparallel shear zones with the same attitude as the shear zone observed on the east shore. Neither zone can be connected on the line of strike to the shear zone on the east shore. The more northern of the two shear zones is 1.5 m in width and contains a 0.5 m wide gossaned siliceous zone in its centre. The siliceous zone is brittle, friable and resembles a chert. Other much narrower shear zones in the outcrop contain similar siliceous zones. The south-

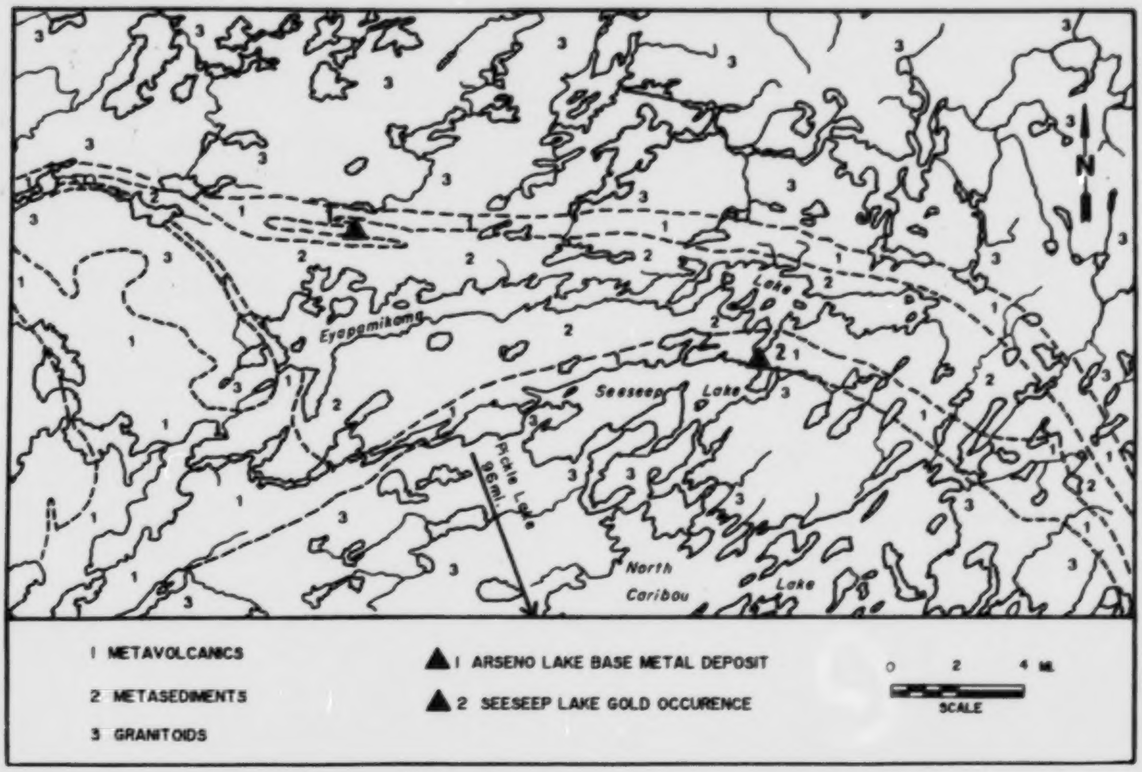

Eyapamikama
Lake
Seeseep Lake
Pickle Lake 96mi.
North Caribou Lake
N
1 METAVOLCANICS
2 METASEDIMENTS
3 GRANITOIDS
1 ARSENO LAKE BASE METAL DEPOSIT
2 SEESEEP LAKE GOLD OCCURENCE
0 2 4 MI.
SCALE

Figure 4.7. Location map for the Arseno Lake base metal deposit and the Seeseep Lake gold occurrence.

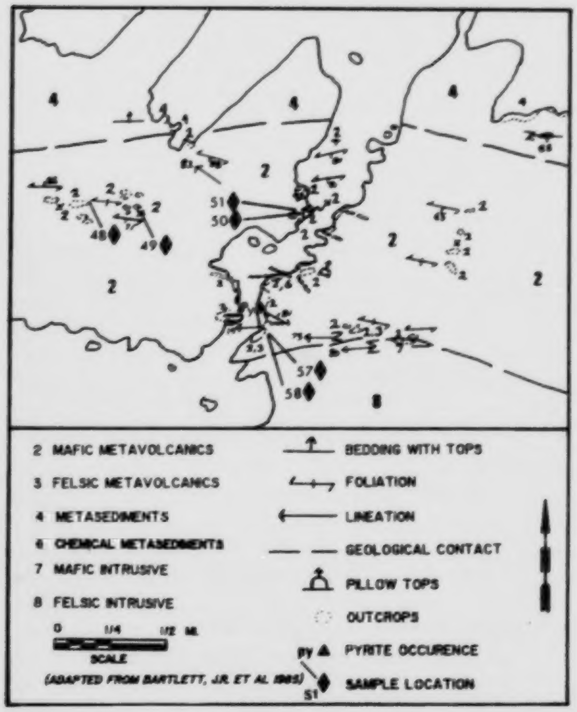

51
50
48
49
57
58
2 MAFIC METAVOLCANICS
3 FELSIC METAVOLCANICS
4 METASEDIMENTS
6 CHEMICAL METASEDIMENTS
7 MAFIC INTRUSIVE
8 FELSIC INTRUSIVE
0 1/4 1/2 MI.
SCALE
(ADAPTED FROM BARTLETT, J.R. ET AL 1985)
BEDDING WITH TOPS
FOLIATION
LINEATION
GEOLOGICAL CONTACT
PILLOW TOPS
OUTCROPS
PY PYRITE OCCURENCE
SAMPLE LOCATION

Figure 4.8. General geology around the Seeseep Lake gold occurrence.

ern shear zone is about 1 m in width and, though weakly mineralized, does not have a siliceous zone. Minor faults that strike 130° and dip to the southwest displace both the shear zones. The apparent displacements are up to 0.5 m and are right handed. Similar right-handed faulting can be used to explain why the shear zones are not continuous across the channel. Geocanex Inc. took many grab and channel samples from the shear zones. None of the samples were anomalous in gold.

Approximately 150 m to the north of where the location of sample No. 58 is indicated by Bartlett (1985), a pyrite occurrence symbol is indicated on the map. At this location, narrow shear zones striking 100° and dipping 80°S cut the mafic metavolcanics. The shear zones contain 1 to 3 percent disseminated pyrite and many quartz stringers. Geocanex Inc. took a few grab samples from the shear zones. The gold content of the samples ranged up to 995 ppb gold. Geocanex Inc. traced the zone in outcrops to the west for approximately 425 m.

THE ONTARIO GOLD JOINT VENTURE ARSENO LAKE BASE METAL PROSPECT

Introduction

In their 1988 Annual Report, Northern Dynasty Explorations Ltd., operator for the Ontario Gold Joint Venture, reported a drill-indicated mineral inventory of 1.0 million tons grading 8.7 percent combined lead and zinc and 1.5 ounces silver per ton on their Arseno Lake property. The mineral inventory was based on the results of a 1988 diamond-drilling program. The base metal deposit is open along strike and at depth. (D. Elsby, Northern Dynasty Explorations Ltd., personal communication, 1989.)

In August, the second author examined the "Main Showing" outcrop of the Arseno Lake base metal deposit and the core from diamond-drill hole A-88-1 collared 350 m to the west of the "Main Showing".

Location and Access

Ontario Gold Joint Venture's Arseno Lake property is approximately 170 km north-northwest of Pickle Lake. Eyapamikama Lake, 2 km to the south of Arseno Lake, is suitable for float-equipped aircraft. Northern Dynasty Explorations Ltd.'s camp site is on the north shore at the northwest end of Eyapamikama Lake. A trail leads from Northern Dynasty Exploration Ltd.'s camp site north to Arseno Lake. In winter, a seasonal road to the Weagamow Lake Indian Reserve 87 can be used to access the Eyapamikama Lake area.

Exploration History

There is no recorded exploration activity on the Arseno Lake property prior to 1984. In 1984, Dunlop Exploration under contract to the Ontario Gold Joint Venture prospected the area north of Eyapamikama Lake. Their prospecting efforts found several new and old (no previous record) gold showings. Dunlop Exploration staked claims to protect what they had found. Northern Dynasty Explorations Ltd. conducted geological, geochemical and geophysical surveys on their claims in 1985 and 1986. Northern Dynasty Explorations Ltd. conducted a 975 m diamond-drilling program on the Arseno Lake property in 1987. Encouraged by the results of the drilling program, Northern Dynasty Explorations Ltd. staked additional claims and conducted further geochemical and geophysical surveys. This was followed by 1:5000 scale geological mapping of the Arseno Lake property. A second diamond-drilling program totalling 1700 m was conducted late in 1987. Extensive base metal sulphide mineralization was intersected in this drilling program. Northern Dynasty Explorations Ltd. conducted a third diamond-drilling program totalling 1464 m in 1988.

Regional Geology

Satterly (1940) mapped the North Caribou Lake greenstone belt for the Ontario Department of Mines at a scale of 1:63360. Bartlett et al. (1985) mapped the geology of the Eyapamikama Lake area at a scale of 1:31680 as part of the Opapimiskan Lake Project. The Ontario Geological Survey also had an airborne magnetic and EM survey flown over the North Caribou Lake greenstone belt coincident with the mapping by Bartlett et al. (1985).

The Eyapamikama Lake area is at the northwest end of the North Caribou Lake greenstone belt. The greenstone belt is structurally a large synclinorium. The synclinorium has a rim of predominantly mafic metavolcanics and a core of predominantly metasediments. Iron formations occur at and near the contact of the mafic metavolcanics with the metasediments. The Arseno Lake property is on the north limb of the synclinorium. The claim group covers the contact area between the mafic metavolcanic rim and the metasedimentary core for a strike length of 14 km. The contact between the two rock units is very complex as it is overprinted by a 700 m wide ductile deformation zone that parallels the contact. Northern Dynasty Explorations Ltd. refer to the contact area as the "Active Zone". The intercalated rock types of the "Active Zone" include pelitic schists, metasedimentary debris flows and conglomerates, mafic metavolcanics, intermediate to felsic pyroclastics and iron formation. Polyphase deformation makes tracing of individual units through sparse outcrop extremely difficult. A horizon of internally folded iron formations is the one traceable unit in the "Active Zone". The iron formations are very silica rich and are composed of recrystallized chert, grunerite, magnetite, pyrrhotite, pyrite, sphalerite, galena and arsenopyrite. Elsby (1988) listed the following as a north to south schematic sequence through the "Active Zone":

Intercalated pelitic schist, carbonate-actinolite schist and chromium mica schist

Mafic metavolcanics

Quartz-grunerite-iron formation horizon, local argillite

Pelitic schist, chromium mica schist

Metasedimentary debris flow

South of the "Active Zone" are more mafic metavolcanics. Farther south are phylitic turbidites.

Northern Dynasty Explorations Ltd. recognize four phases of deformation in the Arseno Lake area. The first two phases are recognized as fold structures within the ductile deformation zone. They resulted in a strong, steeply north-dipping, east-trending axial planar foliation and moderate to steeply east-plunging mineral and intersection lineations. The third phase of deformation produced a well-developed, north-trending crenulation cleavage in the metasediments to the south of the "Active Zone". The fourth phase of deformation produced northeast-trending fractures and joints with associated minor faulting.

Property Examination

The "Main Showing" is an outcrop in the middle of a muskeg swamp, 500 m north-northeast of Arseno Lake. Northern Dynasty Explorations Ltd. stripped the moss off the outcrop and dug a trench. They exposed a total of 10 m of stratigraphy. At the north end of the outcrop is 1 m of massive, fine-grained basalt. Farther to the south is approximately 1 m of biotite schist, cut by many anastomosing seams of chlorite, followed by approximately 1 m of fine-grained basalt. South of the basalt is a 3 m unit of biotite-chlorite schist with many bands and elongate pods of rusted garnet-biotite schist. This grades rapidly into a 3 m unit of garnet-biotite-chlorite schist. A crude layering is defined by the concentration and size of the garnets. A prominent lineation plunging 65° at a strike of 085° is easily observed in this unit. In the southernmost metre of the garnet-biotite-chlorite schist, sericite and quartz become noticeable and increasingly abundant components of the rock. Throughout the entire outcrop there is a pronounced foliation or schistosity striking 100° and dipping 80°N to vertical. There is a sharp contact between the garnet-biotite-sericite-chlorite-quartz schist and the heavily gossaned siliceous iron formation. The siliceous iron formation, as exposed at the "Main Showing", is composed of more than 90 percent quartz (recrystallized chert). The remainder of the iron formation is made up of grunerite, magnetite and sulphides. There are pods within the iron formation containing greater amounts of sulphides. Northern Dynasty Explorations Ltd. channel sampled across the iron formation and received an assay result of 3.6 percent zinc, 4.9 percent lead, 8.1 ounces silver per ton and 0.032 ounce gold per ton across 1.1 m. South of the iron formation the bedrock is under overburden.

Diamond-drill hole A-88-1 was collared 350 m west of the "Main Showing". The hole encountered 4.8 m of overburden and was drilled at 65°. From 4.8 to 171.7 m, the hole cut a sequence of mafic metavolcanics consisting of intercalated basalt, biotite-chlorite schist and chlorite schist with occasional thin layers of grunerite-bearing iron formation. A gabbroic intrusive cuts the sequence from 70.3 to 97.0 m. The mafic metavolcanics are similar to those rocks exposed in the northern 6 m of the "Main Showing". A garnet-biotite-chlorite schist from 171.7 to 177.3 m follows the mafic metavolcanic sequence. The garnet-biotite-chlorite schist contains loosely packed 2 by 5 cm elliptical fragments. The second author considers the schist to be of pyroclastic origin. The garnet, biotite and chlorite minerals, which are accompanied by some sulphides, are possibly the product of sea floor alteration followed by lower amphibolite grade metamorphism. Rocks of similar composition are found associated with base metal mineralization in three other areas of the Sioux Lookout Resident Geologist's District. The garnet, chlorite and sulphide content of the schist increases towards a sharp contact with the mineralized iron formation horizon.

The mineralized iron formation horizon extends from 177.3 to 208.5 m. The horizon consists of siliceous iron formation and sulphide-rich iron formation interlayered with sericite and sericite-biotite schist. The siliceous iron formation is similar in composition to the iron formation exposed at the "Main Showing". The sulphide-rich iron formation contains 25 percent disseminated sulphides and 75 percent massive sulphides. Pyrrhotite and pyrite are the principle sulphides though the sphalerite concentration locally exceeds 30 percent. Chalcopyrite and galena are also present. The 4.8 m interval from 183.7 to 188.5 m averages 9.26 percent zinc, 0.22 percent lead, 0.27 percent copper, 2.17 ounces silver per ton and less than 0.01 ounce gold per ton. The interval from 190.1 to 192.5 m (2.4 m) averages 5.43 percent zinc, 0.04 percent lead, 0.13 percent copper and 0.32 ounce silver per ton.

The sericite and sericite-biotite schists interlayered with the mineralized iron formation are very schistose and highly contorted. The schistosity is folded about axial planes 10° to 40° to the core axis. A crenulation cleavage is oriented at 90° to the schistosity. There are bands of garnet-biotite schists intercalated with the sericite-biotite schist. The second author interprets the sericite and sericite-biotite schists as the products of hydrothermal leaching associated with the mineralizing fluids. The bands of garnet-biotite schists may be remnants of an earlier rock type. The second author did not observe aluminosilicate alteration minerals in the sericite and sericite-biotite schists.

Downcore of the mineralized horizon are interlayered sericite schists, biotite-sericite-chlorite-garnet schists, sericite-chromium mica schists and chlorite-garnet-biotite ± pyrrhotite schists. These schists are interpreted as altered metavolcanics and metasediments. A 2.4 m talc schist unit, presumably an ultramafic dike, cuts the succession just below the mineralized horizon. A 0.6 m sulphide-rich iron formation (mostly pyrrhotite) and a 5.3 m siliceous iron formation were intersected with the schists below the mineralized horizon. The drill hole ended at 261.8 m.

Discussion

The base metal mineralization and associated alteration at Arseno Lake appears to be the result of syn-volcanic hydrothermal activity. Elsby (1989) compared the Arseno Lake mineralization to Noranda Inc.'s, Geco volcanogenic massive sulphide orebody at Manitouwadge, Ontario. In both places, the base metal mineralization occurs along the contact between a mafic metavolcanic succession and an overlying metasedimentary succession. At the Geco Mine, the ore mineralization is contained within a sericite schist unit and is capped by siliceous iron formations which extend into the overlying quartzite unit (Friesen et al. 1982). At Arseno Lake, the mineralized horizon contains sericite schist layers and, at least in diamond-drill hole A-88-1, is capped by a siliceous iron formation layer (205.3 to 208.5 m). At Manitouwadge and at Arseno Lake, the base metal mineralization can be traced along strike and is contiguous with banded oxide facies iron formation.

The alteration minerals at the Geco Mine are much more prevalent than they are at Arseno Lake. A factor which may have contributed to this is an upper amphibolite metamorphic grade at the Geco Mine compared to a lower amphibolite grade at Arseno Lake. At Arseno Lake, aluminosilicate alteration minerals may very well be present, but are too fine grained to be seen by the naked eye.

Though not observed by the second author, arsenopyrite is known to occur with the other sulphide minerals at Arseno Lake. Arsenopyrite is not usually found in volcanogenic massive sulphide deposits. According to Northern Dynasty Explorations Ltd., the arsenopyrite is associated with a gold mineralization event that accompanied the second phase of deformation. The gold mineralization event deposited widespread arsenopyrite mineralization in the iron formations along the north limb of the North Caribou Lake synclinorium.

SABIN BASE METAL PROSPECT, SAVANT LAKE AREA

Introduction

Umex Inc. conducted regional and detailed base metal exploration programs during the 1970s over the north Sturgeon Lake to Savant Lake section of the Wabigoon Subprovince. The area hosts several minor base metal occurrences which were examined by exploration companies following the discovery of the south Sturgeon Lake base metal deposits between 1968 and 1972.

During the course of their exploration programs, Umex Inc. discovered and drilled the Sabin deposit, a small zinc-copper-silver-lead zone containing 200000 to 300000 tons of 5 percent zinc-equivalent base metals (R. Dehenne, Umex Inc., personal communication, 1980). The deposit did not outcrop. During the summer of 1980, a stringer zone surrounding a narrow sulphide lens was exposed during the excavation of Marchington Road (Highway 516). The first author examined and sampled the road cut before it was covered by the backfilling of the road bed. This property examination is presented because of the increased interest in base metals in the area.

Location

The property is located on the Marchington Road (Highway 516), approximately 1.5 km to the west of the intersection with Highway 599 (Figure 4.9). This intersection is approximately 8 km north of the village of Savant Lake. Highway 516 connects Sioux Lookout to Highway 599 and was built primarily for forestry operations; it is a paved, all-weather road.

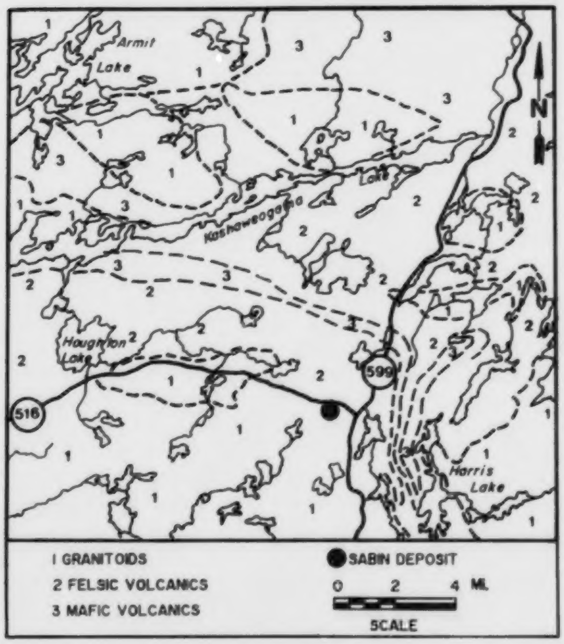


Figure 4.9. Location map for the Sabin base metal deposit.

Exploration History

There are no records of previous exploration of this particular property. However, two small, similar occurrences were discovered during road construction on Highway 599 in 1969. The occurrences are located to the south of the Marchington Road–Highway 599 intersection. The larger of the two is known as the Hadley occurrence. On the west side of Highway 599, a small pit contains a vertical 0.3 to 0.4 m wide band of massive sphalerite and galena in intermediate metavolcanics. The band strikes 075° and is exposed for a maximum of 3 m. Pyrite and chalcopyrite occur in a minor stringer zone around the massive sulphide band (Trowell 1986).

Regional Geology

This area was mapped in part by Bond (1980) at a scale of 1:15840. Trowell (1986) mapped to the south and covered the site of the Sabin deposit.

The rocks in this area are of Archean age and were mapped by Bond (1980) as belonging in the Handy Lake volcanic sequence. This is a mixed unit of felsic and mafic metavolcanics with derived clastic and chemical sediments. This sequence overlies the Jutten volcanic sequence which is mainly composed of mafic metavolcanics and lesser amounts of felsic metavolcanics and sediments. Both sequences occur within a large syncline, the Savant Lake Syncline. For a fuller description of the regional geology, the reader is referred to Bond (1980).

Property Examinations

The first author initially spent a day in June 1980, examining the outcrop on the road cut and outcrop areas within a 100 m radius of the prospect. Over the next eight years many stops were made in this area, in the company of a number of Ministry of Northern Development and Mines staff and geologists from other organizations. All of these people contributed in some way to the first author's understanding of the geology of the area. In particular, the first author would like to thank A. Pryslak and J. Franklin for their insights and contributions. H. Brown visited the site, at the first author's request, and her observations are included in part in this description.

The rocks in the area are highly deformed and greatly altered and replaced. The main rock types in the deposit area were mapped by Bond (1980) and Trowell (1986) as intermediate metavolcanic flows and tuffs. No original textures, other than a crude layering, have been preserved. Within 200 m of the deposit, fragmental textures can be observed. Two nearly parallel foliations occur in the more massive rocks; one strikes 260° and dips 80°N. The other foliation strikes 070° and dips 80°S. As the location of the prospect is approached, the rocks become bleached, silicified and rusty, due to widespread pyrite mineralization in the 1 to 5 percent range.

The prospect is located in an outcrop area, which extends approximately 100 m on both sides of the high-

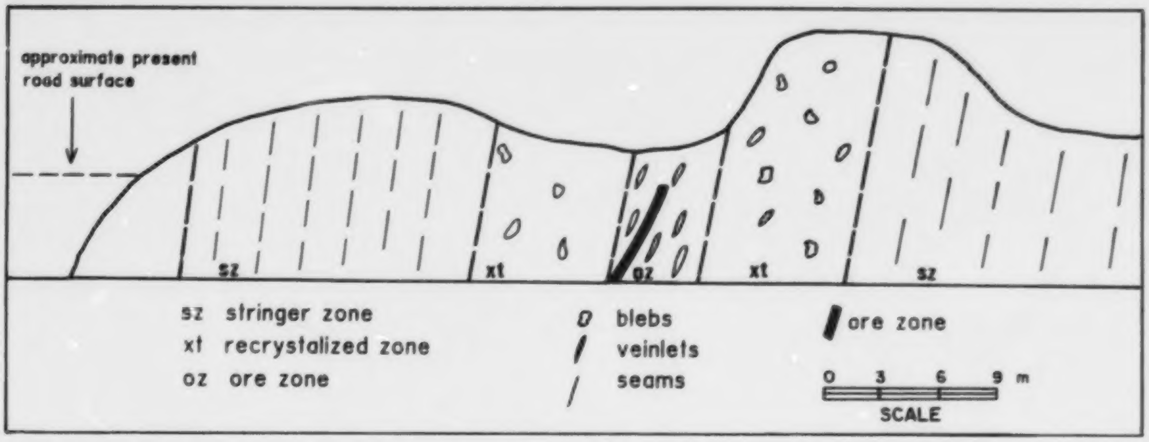


Figure 4.10. South face of road cut trending 120°, Sabin prospect.

way. On the south side of the highway the first author located the collars of six drill holes. Umex Inc. completed at least 24 diamond-drill holes in this area.

The south face of the road cut in June 1980, displayed a symmetrically zoned alteration halo, centred on a narrow, 13 cm wide massive sphalerite-galena band, with an apparent dip of 70° to the southeast. The road cut trends approximately 120°. Drill intersections of massive sphalerite-galena bands indicate a strike of 070° and a dip to the northwest (R. Dehenne, Umex Inc., personal communication, June 1980). This is at variance to the apparent dip of the sulphide section seen in the road cut. A number of outcrops in the area display discontinuous, apparently bedded felsic bands, which trend from 000° to 060° and dip steeply southeast to south. Frequently, these bands were described as metamorphic layering by geologists during property visits. Many of these bands are open folded with axial traces trending eastward. Away from the altered road cut, more massive, highly altered felsic bands containing andalusite, sillimanite, and in places staurolite, display this same open-fold style. The first author believes that many of these bands are beds of felsic composition, striking roughly northeast and folded with axial fold traces trending west to southwest. This may explain the differences in strike and dip of the roadside subcrops and the drill-indicated dip and strike of the sulphide lenses. Figure 4.10, shows the zoning and mineralization noted by the first author in 1980.

At the east of the road cut, there is a 7 m wide silicified, grey, pyrite stringer zone that is strongly foliated with 1 to 2 percent pyrite and dark green (magnesian?) chlorite which occur together in seams or slips within the rock. There is a gradational contact to the west, with an approximately 4 m wide band of rock notably lighter in colour. This band has a metamorphic reorganization into felsic and more mafic domains, usually as sinuous blebs to veins parallel to foliation. The sulphides found are pyrite, with lesser amounts of chalcopyrite, and reach a maximum of 5 percent. There are a few later veins, conformable with foliation, which contain sphalerite and galena. The major mafic mineral is a porphyroblastic, dark green amphibole.

The central portion of the alteration halo is approximately 3 m in width. It is massive to slightly foliated and light grey in colour. Veinlets, parallel to foliation, are present and they contain pyrite, chalcopyrite, sphalerite and minor galena. A few small vugs are present and are filled with pyrite and other sulphides. In the middle of this zone, there is a 12 to 15 cm band of massive sulphides, predominantly sphalerite with minor galena. To the west, the previously described zonation is present as a mirror image.

A number of holes, drilled in the Umex Inc. exploration program over the area, intersected mineralization over widths from 3 to 11 m. The copper assays ranged from 0.4 percent to 4.28 percent copper. Zinc values ranged from 0.2 to 7.5 percent zinc with lesser amounts of lead and between 1 to 5 ounces silver per ton. Gold values ranged from 0.003 to 0.03 ounce gold per ton. From this data, Umex Inc. calculated a geological reserve of approximately 250000 tons, at a grade of 5 percent zinc equivalent (R. Dehenne, Umex Inc., personal communication, 1980).

Discussion

The prospect described in this report, and the Hadley occurrence, resemble in many respects the type of mineralization found in the Sturgeon Lake base metal camp. The possibility that the felsic metavolcanic section in this area has been folded, along an eastward axis, suggests that these mineralized lenses may occur along fold limbs. The potential for other lenses, or greater widths and grades at fold noses, may exist and should be taken into account in any exploration program. This area is highly altered, as evidenced by the metastable aluminosilicate assemblages. This feature is noted in the south Sturgeon Lake camp and in other base metal mines in Ontario.

THE HORN AREA, NORTH STURGEON LAKE

Introduction

Sturgeon Lake is located in the Patricia Mining Division, at latitude 50°N, close to the boundary with the Thunder Bay Mining Division. The lake is approximately 70 km long and from 1.5 to 10 km wide. Gold exploration has been conducted in this area since the discovery in 1898 of gold-bearing quartz veins. Gold prospecting has centred on the northern half of the lake. The southern portion became better known for base metals, with the discovery, exploration and exploitation of three base metal mines from 1969 to the present. One gold mine was developed in the north half of the lake; this is the St. Anthony Mine, which operated episodically between 1911 and 1941. The St. Anthony Mine produced over 63000 ounces of gold from gold-bearing quartz veins. This report deals with several gold occurrences and prospects in the "Horn" area, a peninsula which separates the North Arm and Northeast Arm of Sturgeon Lake.

Location and Access

The properties are located in the North Arm of Sturgeon Lake, north of latitude 50° (Figure 4.11). These areas are located on the tip of the Horn peninsula; on the west side of North Arm opposite the Horn; and on a small island in the North Arm.

Access to the north half of the lake is from boat-launching points, both public and private, from Highway 599 which connects the town of Ignace to Pickle Lake. Float- or ski-equipped aircraft can land in most locations on this deep, wide lake. A float plane base operates during the summer at the north end of Sturgeon Lake.

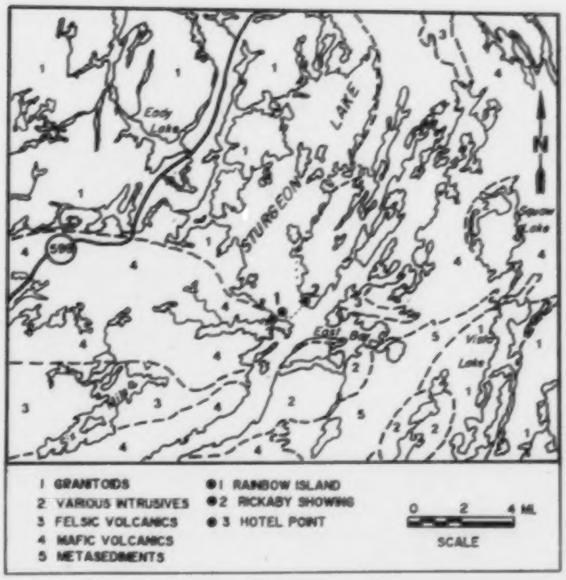

Eady Lake
STURGEON LAKE
599
N
1 GRANITOIDS
2 VARIOUS INTRUSIVES
3 FELSIC VOLCANICS
4 MAFIC VOLCANICS
5 METASEDIMENTS
●1 RAINBOW ISLAND
●2 RICKABY SHOWING
● 3 HOTEL POINT
0 2 4 Mi.
SCALE

Figure 4.11. Location map for the Rainbow Island, Rickaby showing and Hotel Point gold occurrences.

Exploration History

E.S. Moore is the best source for the early history of exploration on Sturgeon Lake (Moore 1911). Gold was first discovered in the summer of 1898. By 1901, the Jack Lake Mine (later renamed the St. Anthony Mine) had been discovered and was under exploration and development. A number of other properties were discovered and explored. By 1909, when Moore mapped the area, a large number of properties had become inactive. Periodic exploration plays occurred in the 1920s and 1930s when the price of gold was favourable. All development and exploration ceased in 1941 for the duration of the war.

A.R. Graham remapped the area surrounding the lake in 1929 (Graham 1930). He reported on the St. Anthony Mine in considerable detail and several other properties in brief summaries.

Moore's map recorded two of the prospects described herein. The first is located in the "Horn" area on claim BG130. The second is located on claim AL499, an island 1.2 km southwest of claim BG130. The third prospect has no recorded exploration history and is located on the east shore of the North Arm, 0.8 km north of Hotel Point (Figure 4.12).

The island prospect (AL499) was reported on by Moore (1911) as described in the following:

> "On this island there is a contact between greenstone in the form of altered diabase, green schist and quartz-porphyry, which in places becomes more like granite than quartz-porphyry, and may be regarded as a phase of the granite. The veins occur in the greenstone and schist, in the porphyry and along the contact between the two. The quartz in most of the veins is dark and favourable looking, although one vein appears barren. One of these veins runs nearly across the island. A shaft

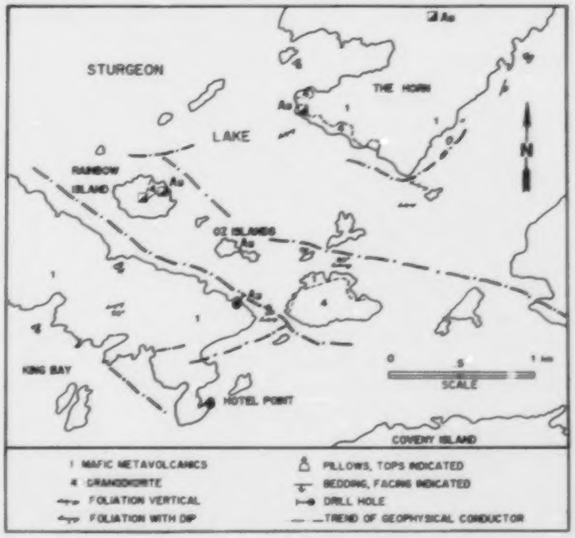

STURGEON
LAKE
THE HORN
RAINBOW ISLAND
OZ ISLANDS
KING BAY
HOTEL POINT
COVENY ISLAND
Au
N
0 .5 1 km
SCALE
1 MAFIC METAVOLCANICS
4 GRANODIORITE
FOLIATION VERTICAL
FOLIATION WITH DIP
PILLOWS, TOPS INDICATED
BEDDING, FACING INDICATED
DRILL HOLE
TREND OF GEOPHYSICAL CONDUCTOR

Figure 4.12. Prospects in the Horn area, Sturgeon Lake.

> 25 feet deep and 9 x 7 feet, has been sunk on a group of one large and many smaller veins. In the shaft there is a dike-like mass of porphyry, and there is some evidence of a slip horizontally part way down the shaft, while at the bottom there is a mass of greenstone. As this greenstone is older than the vein it has not intruded it, and although the vein may have pinched here it may reappear on either side of this mass.
>
> There are many little stringers in the quartz-prophyry, suggesting that the fissures had been developed at the time of cooling and contraction of this rock. From one of these little veins some gold was panned, and the dark quartz from the shaft also showed fair values, but we did not find any visible gold, and the owner stated that it seldom occurred, although this property has had a local reputation for supplying unusual samples of free gold."

Sometime after Moore's mapping in 1909, another shaft was sunk on this vein structure.

K.F. O'Flaherty did trenching in 1973. He also supplied a rough map showing the locations of seven drill holes on the north half of the island. No report was submitted on the drill holes or mechanical work (Assessment Files, Sioux Lookout Resident Geologist's office, 52 J/07 Se-0055-A1).

In 1982 to 1983, K. Kuhner optioned the property from the owner and attempted to mine two blue quartz veins on the island. By this time, the property was locally known as Rainbow Island.

In 1989, 007 Precious Metals Inc. optioned the property and conducted geophysical, geological and drilling programs on the island.

The Exploration History of BG130

Though Moore (1911) did not report on the property, an old shaft was sunk on this property near the lake shore. A small trench appears to have been excavated at some time. In 1973, L.W. Green acquired the rights to the patented property and did trenching on the prospect. In 1979, Rickaby Mines bought the property and conducted a stripping, trenching and sampling program. No results were released. Rickaby Mines' Ontario charter was cancelled in April 1985 (Canadian Mines Handbook 1986–87, p.325).

Regional Geology

The portion of Sturgeon Lake referred to in this report was most recently mapped by Trowell (1983). A summary of the geology of the area from Blackburn and Janes (1983) follows:

> "The northern portion of the lake hosts more than twenty gold occurrences, aligned along several structural trends. The area is underlain by a roughly north-trending band of mafic to felsic volcanic extrusive and intrusive rocks with trends roughly parallel to the belt boundaries. This trend is truncated at East Bay and King Bay where the foliation and formational boundaries swing to an east-west direction. The section exposed between North and Northeast Bays of Sturgeon Lake consists of a basal basaltic unit overlain to the east by an andesitic to felsic tuffaceous assemblage. A major fault with a well defined mylonitic zone extends down Northeast Bay and may extend the length of Sturgeon Lake. A secondary fault or shear zone extends through East Bay and is host to a sulphide zone. Shearing is widespread in King Bay but is not localized in a defined zone. The volcanic rocks have been intruded by sills and stocks of alkalic syenite and nepheline syenite to the south of East Bay. Minor ultramafic sills and at least one possible ultramafic extrusive or fragmental rock has been found in Northeast Bay. The base of the mafic section has been intruded by the Lewis Lake Batholith along North Bay. The batholith is a composite body containing migmatitic, gneissic and leucocratic-equigranular granodiorite phases. Undoubtedly several intrusive phases are present, possibly differing considerably in age, and detailed mapping will be required if reliable age relationships are to be defined. The relative ages of the various phases of the batholith are important because of the structural control of several gold deposits at the granodiorite-volcanic contact."

Property Examinations

BG130

An old water-filled pit is located just off the shoreline on this property. Rickaby Mines stripped and trenched a 100 by 40 m wide area to the northeast of the pit. At least six trenches were excavated along a shear zone trending 075° and dipping 60°S. The shear zone is parallel to a breccia of angular 5 to 50 mm sized mafic metavolcanic fragments in a carbonate matrix. The breccia grades to the south into massive fine-grained mafic metavolcanics over a 0.5 to 1.0 m interval.

To the northwest of the breccia, blue to black quartz veins up to 0.3 m in width carry pyrite, chalcopyrite and a few specks of visible gold. The black quartz veining is in contact with medium-grained, grey granodiorite. Later dikes of feldspar porphyritic leucogranodiorite cut the shear zone and truncate at the carbonate breccia contact. The shearing and black quartz veining can be traced for 50 m along the 075° trend into a contact with mafic metavolcanics where the veining pinches out. Gold assays from grab samples taken by the first author varied from 0.01 to 0.56 ounce gold per ton. The highest values were obtained from a sample collected from blue quartz in contact with feldspar porphyry approximately 60 m northwest of the pit. This area had been excavated to a depth of several metres and was partially water filled.

AL499 (RAINBOW ISLAND)

Two shafts were sunk on two *en échelon* quartz veins which trend 080° and dip 60° to 70°S. The veins are located at the sinuous contact of a leucocratic granodiorite phase of the Lewis Lake batholith and sheared, carbonated mafic metavolcanics. The hanging wall contact of the veins consists of a breccia of pea- to cobble-sized angular fragments of mafic metavolcanics in a carbonate matrix. The footwall contact is a slightly feldspar-porphyritic, fine-grained white granodiorite which would be classed as leucocratic due to a low mafic content. The blue to black quartz vein varies from 0.25 to 0.45 m in width. The sulphide mineralization is almost entirely pyrite, with traces of chalcopyrite. The quartz is brecciated and shows crack-seal features. Pyrite content varies widely throughout the vein and gold tenor appears to follow sulphide content. The two shafts were sunk where the veins appear to pinch out; possibly to try and follow the quartz veins at depth. Both veins, which together are exposed for 100 m, have been excavated for 8 to 12 m below surface. K. Kuhner set up a small jaw crusher, ball mill and table which operated for two summers in 1982–83 to recover gold from the two veins.

Mining involved blasting out the footwall; leaving the quartz vein material on the hanging wall. The vein was then scaled off the hanging wall and transported to a small jaw crusher. The crushed ore was fed through a hollow trunion bearing into a small homemade ball mill. The overflow of the ball mill was sent to a table for gold recovery.

This circuit was difficult to control and not particularly suited to the fine, floury gold found in the veins. While gold was recovered on the table, tailing samples taken by the first author during a visit assayed 0.3 ounce gold per ton.

That the gold was fine grained is obvious from the fact that little if any visible gold was found, even in samples which assayed up to 11 ounces gold per ton. The mill proved to be uneconomic and the property was returned to the owner. No records were available of the average gold content of the ore milled. Samples taken and assayed at the Geoscience Laboratories Section of the Ontario Geological Survey gave values from 4 to 11 ounces gold per ton. Since these were selected grab samples, the average grade of the veins would be considerably less. The first author considers that the true grade was approximately 1 ounce gold per ton, based on a number of samples and a visual estimate of the sulphide content of the veins.

Recently, 007 Precious Metals Inc. acquired an option on this property as part of a larger exploration block in the area. The company conducted a drill program on the island during the summer of 1989. Nine drill holes tested various vein structures at depth. Eight holes returned intersections from 0.3 to 1.6 m in width with grades ranging from 0.02 to 0.63 ounce gold per ton. (R. Bernatchez, 007 Precious Metals Inc., personal communication, 1989.)

HOTEL POINT AREA

During the above-mentioned drill program, 007 Precious Metals Inc. drilled one hole near Hotel Point to the south of Rainbow Island. The hole was designed to test a conductor believed to follow the mafic metavolcanic-granodiorite contact. This hole was examined by the first author and appears to have tested a complex, sheared contact between granodiorite and mafic metavolcanics. Intersections totalling 3.5 m in this hole gave grades from 0.04 to 0.10 ounce gold per ton. These results point out the potential for gold mineralization of this relatively untested area.

DISCUSSION

These visits to a small number of properties on the eastern contact of the Lewis Lake batholith point out the gold potential of this area. Gold mineralization has been found over a 19 km long portion of this contact. Much of this contact is underwater and completely untested. While it is true that the only producing mine, the St. Anthony, would be small by today's standards, the potential for a larger deposit cannot be discounted. The association of very late, leucocratic phases of the batholith with gold mineralization should not be overlooked since areas where these intrusive phases occur may mark zones of late stage fracturing during emplacement of the granitoids.

DIAMOND-DRILL CORE STORAGE PROGRAM

The Kenora Drill Core Library provides core storage facilities for the Sioux Lookout Resident Geologist's district. Core stored consists of core from entire drill holes from both exploration and mine development drilling. Incomplete holes recovered from old drill sites and short samples of core submitted for credit under Section 77(6) of the Mining Act (RSO 1980) are also stored. Some of the core has been relogged and sampled by drill core library staff.

Core collected in the Sioux Lookout District from November 21, 1988 to November 23, 1989, totalled 5651.7 m plus an additional 1994.7 m, transferred from storage at Sioux Lookout to Kenora.

The current content of the library consists of 43370.1 m of completely catalogued core stored inside the building, of which 10392.8 m from 104 drill holes is from the Sioux Lookout District, and an additional 19032.2 m, including 3548.1 m from 36 drill holes from the Sioux Lookout District, which is held in secure outdoor storage. The latter is the excess core from several drill projects that were collected in their entirety, and core remaining after some holes were relogged and reduced. This outside-stored core is available for examination at a client's request.

Table 4.6 lists all the Sioux Lookout District core presently in the core library system. Complete catalogues are available from the Sioux Lookout Resident Geologist's office or the Kenora Drill Core Library. A brief summary of core collected up to 1989 is found in Janes et al. (1989).

A large amount of core from the gold, molybdenum and other occurrences near Sioux Lookout had been collected and stored at Sioux Lookout. This material has now been transferred to the Kenora Resident Geologist's office. This includes core from Quyta Gold Mines Limited in Pickerel Township, drilled for gold in 1950 and core from an iron deposit near Botsford Lake drilled by Kerr Addison Mines Ltd. in 1968. Much of this older core could warrant re-examination in light of more up-to-date exploration techniques. Assessment credit core samples from the Sioux Lookout District are now available in the Kenora Drill Core Library. In some cases, they are the only remaining core from some of the older drill projects.

The emphasis in core collecting has been to recover core from the more remote areas of the district. The area around Sturgeon Lake, Savant Lake and Pickle Lake has been targeted for emphasis in upcoming core recoveries.

A large amount of drilling has been carried out on the Armstrong–Best gold deposit in the King Bay area of Sturgeon Lake, including both diamond and overburden drilling. Recovery of this core is under way. To date,

TABLE 4.6. SUMMARY OF SIOUX LOOKOUT DISTRICT CORE IN THE LIBRARY.

AREA	NTS	COMPANY	HOLES
Beckington Lake	52J/02 NE	Grandad Resources Ltd.	1
		Mine Lake Res. Ltd.	3
		Mine Lake Res. Ltd.	5*
Bell Lake	52G/15 SW	Minnova Inc.	5
Conant Township	52J/07 NE	Noranda Inc.	1
Connell Twonship	520/08 NE	Gallant Gold Mines Ltd.	9
	520/09 EE	Kerr Addison Mines Ltd.	3
		Silverside Res. Inc.	3*
Coucheemoskog Lake	520/08 SE	Power Explorations Inc.	22
Echo Township	52F/16 NW	Braeswood Exploration Ltd.	3
		Brasswood Exploration Ltd.	8*
		Rio Tinto Canadian Exp. Ltd.	3
		Rio Tinto Canadian Exp. Ltd.	4*
Fourbay Lake	52J/02 SW	Riverton Resources Corp.	4
Fry Lake	520/03 NW	Umex Inc.	12*
Kawashe Lake	520/06 SE	Ateba Mines Ltd.	5
Kecheokagan Lake	53B/02 NW	Great Plains Dev. Co.	3
Lomond Township		Nahanni Mines Ltd.	1
Nemeigusabins Lake	53H/12 SW	Platinum Exp. Canada Inc.	9
Parnes Lake	52G/13 NW	Denison Mines Ltd.	2
Penassi Lake	52G/14 NE	Noranda Inc.	1
Pickerel Township	52F/16 NE	Quyta Gold Mines Ltd.	3
		Quyta Gold Mines Ltd.	7*
		Bealmont Red Lake Gold Mines Ltd.	1
		Bealmont Red Lake Gold Mines Ltd.	2*
		Tarbush Lode Mining Inc.	7
Sixmile Lake	52G/15 NW	Noranda Inc.	2
		Santana Petroleum Corp.	10
Smock Lake	52G/13 NE	BHP-Utah Mines Ltd.	3*
Squaw Lake	52J/02 SE	MPH Consulting Ltd.	3
Tarp Lake	520/09 SE	H. J. Hodge Inc.	9
		Kerr Addison Mines Ltd.	2
Vermilion Township		Moneta Porcupine Mines Inc.	6
Whipper Lake	52K/01 SW	Nahanni Mines Ltd.	1
Zarn Lake	52J/04 SE	Goldwinn Resources	1
		Goldwinn Resources	2*
		Kerr Addison Mines Ltd.	2*

* Indicates core added since November 21, 1988.

3145 m have been recovered and is in Kenora being processed (this does not appear in Table 4.6). Core recovered from the Pickle Lake area in 1989 includes core from the Silverside Resources Inc. Tarp Lake property in Connell Township and the H.J. Hodge Inc. Cindy Mae property near Central Patricia.

The core collected recently plus core recoveries in progress or scheduled for the winter of 1990 are the result of gold exploration. Growing interest in base metals makes some of the older core plus any core from the Sturgeon Lake base metals camp of great interest.

RECOMMENDATIONS FOR EXPLORATION

BASE METALS

The Ontario Gold Joint Venture Arseno Lake base metal deposit is an example of a volcanogenic massive sulphide deposit that is not associated with a large felsic metavolcanic pile. It is contiguous with a long iron formation horizon near a major metavolcanic-metasedimentary contact. Volcanogenic massive sulphides of this type may be located by mapping the facies changes along the iron formation horizons and by geophysical methods. It is also important to map out the alteration patterns in the rocks adjacent to the iron formation horizons. Chorlton (1988), in her mapping of the Sandybeach Lake area southwest of Sioux Lookout noted chlorite-actinolite-garnet-magnetite alteration assemblages occurring locally in a dacitic pyroclastic and other metavolcanics adjacent to an iron formation horizon. L. Chorlton traced the iron formation horizon in outcrop from the east boundary of the map area to the west boundary. Near the Goldenrod occurrence, the alteration assemblage pervades both the clasts and the matrix of the dacitic pyroclastic rock. Facies changes have also been noted along the iron formation horizon. Although the Sandybeach Lake area was examined for base metal potential in the past, the area is worth further examination in light of this recent work. Other iron formation horizons in the Sioux Lookout Resident Geologist's district that have a similar geological setting to the iron formation at Arseno Lake occur in the Pashkokogan Lake–Misehkow River section of the Central Uchi greenstone belt and the Minnitaki iron range in the Wabigoon greenstone belt southwest of Sioux Lookout.

The property report on the Sabin deposit near Savant Lake and the Evans Lake programs of Cumberland Resources Ltd. point out the potential for base metal exploration in the Savant Lake–north Sturgeon Lake area. The Ontario Ministry of Northern Development and Mines has announced new airborne geophysical and geological surveys for this area. The presence of favourable geology, good geochemical indicators and the known deposits and occurrences make this area an excellent target area for exploring for zinc-copper-silver-lead deposits.

GOLD

The authors wish to restate the importance of recognizing and exploring for gold mineralization along regional deformation zones. It is most important to recognize the areas of dilatancy within the deformation zones and the splays off the main trend of the regional deformation zones. Within the Central Uchi greenstone belt, recent mapping by the Ontario Geological Survey (for example, Stott and Wilson 1986a, 1986b) has identified several zones of intense deformation and other areas of intense deformation not formally recognized as a deformation zone. The authors in their examination of several gold occurrences in the Central Uchi greenstone belt have noted a direct relationship between the deformation zones and the gold occurrences. The authors recommend that further gold exploration be directed to the areas around these deformation zones, especially where there is a major flexure in the rock units.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Ontario Geological Survey fielded three mapping parties in the Patricia Mining Division in 1989. M. Sanborn-Barrie commenced a synoptic mapping project, with strong structural emphasis, in the Marchington–Savant–Sturgeon lakes area. This area will be covered by an airborne survey commissioned by the Ontario Ministry of Northern Development and Mines. This area has considerable base metal and precious metal potential and is structurally complex. It is hoped that the synoptic mapping will provide some of the answers for exploration programs in the area.

L. Jensen conducted 1:15840 mapping in the Caron Lake area, south of Pickle Lake. This area crosses the boundary between the Uchi Subprovince and the English River Subprovince to the south. To the east, recent discoveries of gold associated with iron-rich metasediments focussed attention on this poorly exposed and little-explored belt. This mapping is designed to improve the data base in this area, which was previously covered by the Pickle Lake geophysical survey.

R. Gorman conducted an aggregate assessment program in the town of Sioux Lookout working circle. This area suffers from a shortage of documented aggregate resources. The recently increased building and construction demands of the area have exhausted known supplies and the Sioux Lookout District of the Ministry of Natural Resources requested this study, in conjunction with the town of Sioux Lookout. R. Gorman evaluated aggregate resources near Sioux Lookout and was able to indicate substantial potential reserves which are undergoing testing.

SELECTED PUBLICATIONS RECEIVED

Beakhouse, G.P. 1988. Reconnaissance investigations of granitoid rocks in the Wabigoon Subprovince; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.149-152.

Breaks, F.W. 1988. Geology of the eastern Lac Seul granulite-amphibolite facies transition zone; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.81-88.

Cortis, A.L., Stott, G.M., Osmani, I.A., Atkinson, B. and Thurston, P.C. 1988. A geological re-evaluation of northwestern greenstone belts; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.28-52.

Fortescue, J.A.C., Stahl, H. and Webb, J.R. 1988. Humus geochemistry in the Lake Opapimiskan area (the Kenpat No. 1 and Musselwhite properties), District of Kenora, Patricia Portion; Ontario Geological Survey, Map 80801, scale 1:15840.

Gorman, W.A. 1989. Vaughan Lake, data base map; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study (NOEGTS) Map 5110, scale 1:100000.

——1989. Marchington Lake, data base map; Ontario Geological Survey, NOEGTS Map 5114, scale 1:100000.

——1989. Churchill Lake, data base map; Ontario Geological Survey, NOEGTS Map 5112, scale 1:100000.

——1989. Slate Lake, data base map; Ontario Geological Survey, NOEGTS Map 5108, scale 1:100000.

——1989. Marchington Lake, sand and gravel resources; Ontario Geological Survey, NOEGTS Map 5116, scale 1:100000.

Hornbrook, E.W.H. and Friske, P.W. 1989. National geochemical reconnaissance lake sediment and water data, northwestern Ontario (52F); Geological Survey of Canada, Open File 1958.

Janes, D.A., Seim, G.W. and Storey, C.C. 1989. Sioux Lookout Resident Geologist's District—1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.65-91.

Jensen, L.S. 1989. Precambrian geology of the Horseshoe Lake area (east half) District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.3128, scale 1:15840.

——1989. Precambrian geology of the Horseshoe Lake area (west half) District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.3129, scale 1:15840.

——1989. Geology of the Horseshoe Lake area, District of Kenora (Patricia Portion); Ontario Geological Survey, Open File Report 5704, 140p.

Johns, G.W. 1988. Geological studies in the Wabigoon Subprovince, Superior Province; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.124-125.

Osmani, I.A. and Stott, G.M. 1988. Regional-scale shear zones in Sachigo Subprovince and their economic significance; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.53-67.

Piroshco, D.W., Breaks, F.W. and Osmani, I.A. 1989. The geology of gold prospects in the North Caribou Lake greenstone belt, District of Kenora, Northwestern Ontario; Ontario Geological Survey, Open File Report 5698, 94p.

Sage, R.P. 1988. Geology of carbonatite-alkalic rock complexes in Ontario: Sturgeon Narrows and Squaw Lake alkalic rock complexes, District of Thunder Bay; Ontario Geological Survey, Study 49, 117p.

Sanborn-Barrie, M. 1988. Geology of the tectonic boundary zone between the English River and Winnipeg River subprovinces, northwestern Ontario; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.98-107.

Stott, G.M., Brown, G.H., Coleman, V.J., Green, G.M. and Reilly, B.A. 1989. Precambrian geology of the Pickle Lake area, western part; Ontario Geological Survey, Preliminary Map P.3056, scale 1:50000.

——1989. Precambrian geology of the Pickle Lake area, eastern part; Ontario Geological Survey, Preliminary Map P.3057, scale 1:50000.

Thurston, P.C. and Stott, G.M. 1988. Northwestern Superior Province; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.12-17.

VanDine, D.F. 1989. Savant Lake, data base map; Ontario Geological Survey, NOEGTS Map 5115, scale 1:100000.

——1989. De Lesseps Lake, data base map; Ontario Geological Survey, NOEGTS Map 5113, scale 1:100000.

REFERENCES

Bartlett, J.R., Breaks, F.W., DeKemp, E.A. and Shields, H.N. 1985. Precambrian geology of Eyapamikama Lake area (Opapimiskan Lake project), Kenora District (Patricia Portion); Ontario Geological Survey, Preliminary Map P.2834, scale 1:31680.

Blackburn, C.E. and Janes, D.A. 1983. Gold deposits in northwestern Ontario; *in* The Geology of Gold in Ontario, Ontario Geological Survey, Miscellaneous Paper 110, p.194-210.

Bond, W.D. 1980. Geology of the Houghton–Hough lakes area (Savant Lake area), District of Thunder Bay; Ontario Geological Survey, Report 195, 112p.

Chorlton, L. 1988. Geological synopsis in the Dinorwic–Sioux Lookout area—The Sandybeach Lake area, northwestern Ontario; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.153-162.

Elsby, D. 1989. Ontario gold joint venture, Arseno Lake property, 1988 diamond drill assessment report, volume I, Patricia mining division, N.T.S. 53B 14/15. Assessment Files, Sioux Lookout Resident Geologist's office, file 53B/14NE-0031.

——1988. Ontario gold joint venture, Arseno Lake property 1986–1987 assessment report. Assessment Files, Sioux Lookout Resident Geologist's office, file 53B/14NE-0029.

Friesen, R.G., Pierce, G.A. and Weeks, R.M. 1982. Geology of the Geco base metal deposit; *in* Precambrian Sulphide Deposits, H.S. Robinson Memorial Volume, Geological Association of Canada, Special Paper 25, p.343-363.

Graham, A.R. 1930. Sturgeon Lake gold area, districts of Kenora and Thunder Bay; Ontario Department of Mines, Annual Report, 1930, v.39, pt.2, p.36-50.

Harding, W.D. 1936. Geology of the Cat River–Kawinogans Lake area; Ontario Department of Mines, Annual Report, 1935, v.44, pt.6, p.53-73.

Moore, E.S. 1911. The Sturgeon Lake gold field; Ontario Bureau of Mines, Annual Report 1911, v.20, pt.1, p.133-157.

North, J.W. 1987. Report on geological mapping, geochemical sampling, prospecting, stripping and chip sampling–Seeseep Lake property, District of Kenora, Patricia Mining Division, northwestern Ontario, (53B/15 NW) for Power Explorations Inc. Assesment Files, Sioux Lookout Resident Geologist's office, file 53B/15NW-0022.

Sage, R.P. and Breaks, F.W. 1982. Geology of the Cat Lake–Pickle Lake area, districts of Kenora and Thunder Bay; Ontario Geological Survey, Report 207, 238p.

Satterly, J. 1940. Geology of the Windigo–North Caribou lakes area; Ontario Department of Mines, Annual Report, 1939, v.48, pt.9, p.1-32.

Stott, G.M. and Wilson, A.C. 1986a. Precambrian geology of the Muskegsagagen–Bancroft lakes area, District of Kenora (Patricia Portion); Ontario Geological Survey, Preliminary Map P.3049, scale 1:50000.

——1986b. Precambrian geology of the Muskegsagagen–Bancroft lakes area, District of Kenora (Patricia Portion); Ontario Geological Survey, Map 2507, scale 1:50000.

Trowell, N.F. 1983. Geology of the Squaw Lake–Sturgeon Lake area, District of Thunder Bay; Ontario Geological Survey, Report 227, 114p.

——1986. Geology of the Savant Lake area, districts of Kenora and Thunder Bay; Ontario Geological Survey, Open File Report 5606, 181p.

Youngman, B.A., Tupper, D.W., Gorzynski, G.A. and Ewen, H.E. 1985. Dempster Lake property, 1985, assessment report. Assessment Files, Sioux Lookout Resident Geologist's office, file 520/06SE-0033.

5. Thunder Bay Resident Geologist's District—1989

M.J. Lavigne Jr.[1], J.F. Scott[2] and P. Sarvas[3]

[1]Resident Geologist, Thunder Bay Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Thunder Bay Resident Geologist's Office, Northwestern Region.

[3]Drill Core Library Geologist, Thunder Bay Drill Core Library, Northwestern Region.

INTRODUCTION

Exploration activity in the Thunder Bay Resident Geologist's District has declined in 1989, in comparison to 1988. Prospectors and major mining companies maintained their level of activity; the overall decline is the result of a decrease in junior mining company activity. Most of the activity once again focussed on gold with only a moderate increased emphasis on base metals. The INCO Limited Shebandowan copper-nickel mine resumed production in March.

MINING ACTIVITY

On January 3, MacIsaac Exploration Ltd. began reconditioning the underground workings and the mill at the INCO Limited Shebandowan Mine (Figure 5.1). The first shipment of nickel-copper concentrates left the mine site on March 26 of 1989. This 2000 ton per day operation has a life expectancy of 3.5 years. The daily concentrate production is 320 tons having an average grade of 11.4 percent Ni and approximately 5 percent Cu. The grade of this deposit is 2.1 percent Ni and 0.95 percent Cu (Gary Willock, INCO Limited, personal communication, 1989).

ADVANCED EXPLORATION ACTIVITY AND DEVELOPMENT

Madeleine Mines Ltd., Lac des Iles Area

Madeleine Mines Ltd. continued with site preparation of its Lac des Iles platinum group metals prospect (Figure 5.1). This includes overburden removal at the open-pit site, the installation of a crushing circuit, and flotation cells. The first blast in the new open pit also took place this year.

Mimiska Mining Company Inc., Fern-Elizabeth Prospect

Mimiska Mining Company Inc. carried out a feasibility study on its Fern-Elizabeth prospect (Figure 5.1). As the result of this study, drill-indicated reserves on the No. 1, No. 2, No. 6 and Grizzly veins now stand at 375000 tons with a grade of 0.18 ounce gold per ton. In 1989, Mimiska carried out 33250 feet of diamond drilling in 65 holes on its Atikokan property. Of this total, 11362 feet (21 holes) was drilled southwest of Harold Lake where 10 holes investigated the Zephir zone and outlined 44000 tons grading 0.19 ounce gold per ton (Bill Yeomans, Mimiska Mining Company Inc., personal communication, 1989). The Zephir zone was discovered by D. Stone (geologist) during the course of a regional mapping program being carried out by Atomic Energy Canada Ltd. Twenty samples collected by D. Stone from this zone were analyzed by neutron activation. The results clustered around 400 to 500 ppb Au, with a high value of 1100 ppb Au (D. Stone, Ontario Geological Survey, personal communication, 1989). This discovery and these results were never released. The zone consists of a network of quartz veins hosted by sheared felsic metavolcanics. Mimiska Mining Company Inc.'s best drill intersection averaged 6.14 g/t gold over 10.53 m.

EXPLORATION ACTIVITY

Exploration activity in the Thunder Bay Resident Geologist's District has decreased dramatically in 1989 (*see* Figure 5.1). As measured by the number of active properties, the level of activity has decreased by 38.0 percent. In 1989, 65 properties were active in comparison to 105 in 1988. Thirty of these properties were explored by junior mining companies as compared to 57 in 1988. Eighteen properties were explored by major mining companies as compared to 21 in 1988. The level of activity in this district in 1989 is similar to 1987.

The advent of the Ontario Prospectors Assistance Program resulted in a flurry of activity at the end of this report year.

The decrease in the level of exploration activity for the Thunder Bay Mining Division, if measured by the number of man days of assessment work filed (*see* Table 5.1), is 36.5 percent.

Of the 65 properties being explored in 1989, 7 programs were directed at base metals, 5 at platinum group metals and the balance for gold (*see* Table 5.2). In 1988, only 3 programs were directed at base metals and 15 at platinum group metals. The reduction in the number of platinum group metal exploration projects reflects the dominance of junior mining companies in platinum group metal exploration and the gradual elimination of good targets by negative results.

Much of this activity was focussed on the Shebandowan greenstone belt. For example, Noranda Exploration Company, Limited, examined six properties and INCO Gold Company evaluated four properties. The

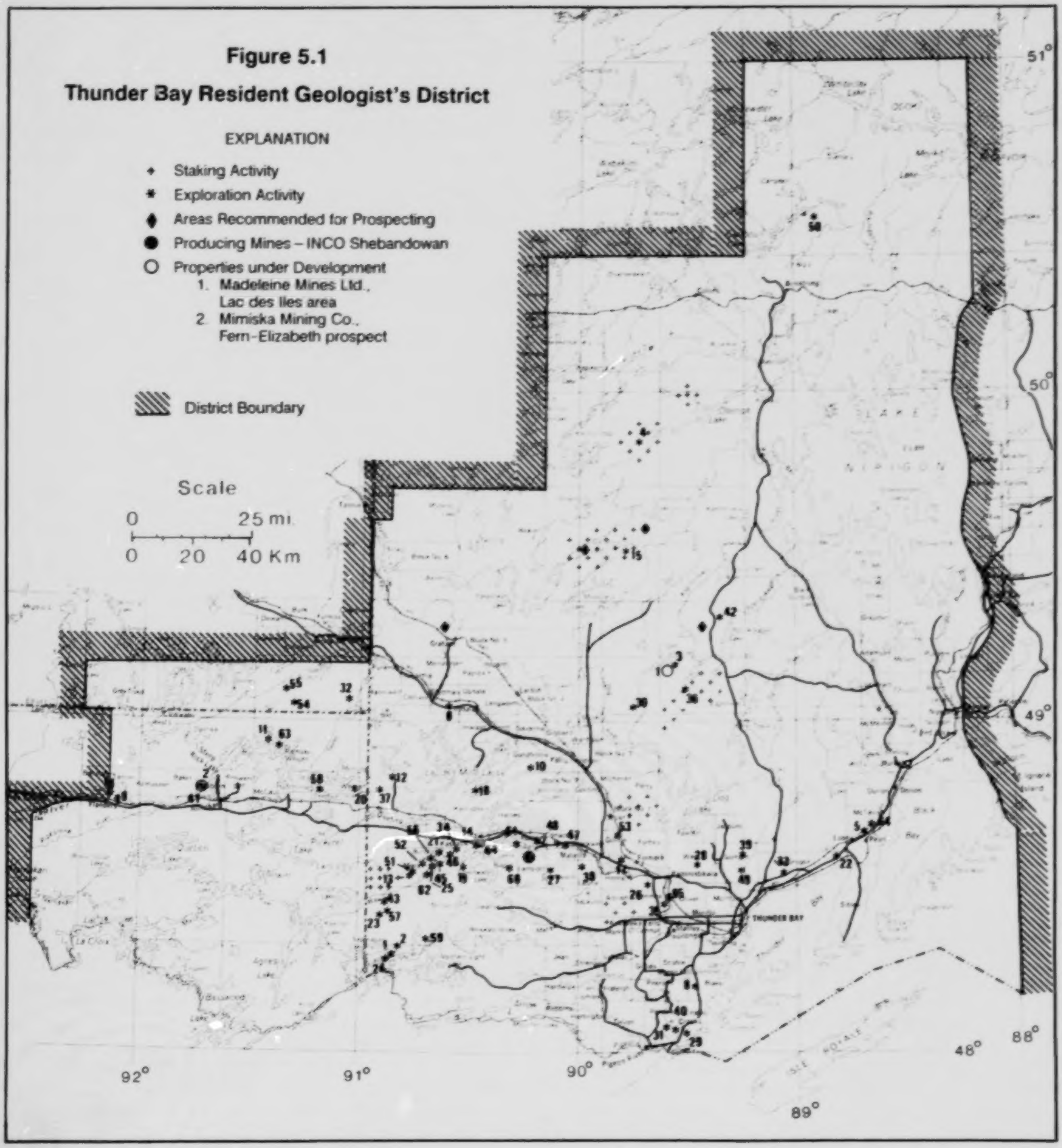


Figure 5.1
Thunder Bay Resident Geologist's District

EXPLANATION
✦ Staking Activity
✱ Exploration Activity
◆ Areas Recommended for Prospecting
● Producing Mines – INCO Shebandowan
○ Properties under Development
1. Madeleine Mines Ltd., Lac des Iles area
2. Mimiska Mining Co., Fern-Elizabeth prospect
▨ District Boundary
Scale
0 25 mi
0 20 40 Km
51°
50°
49°
48°
92°
91°
90°
89°
88°
LAKE NIPIGON
THUNDER BAY
ISLE ROYALE

TABLE 5.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1970	5,830	4,192	10,417	103,559	83,389	6,078	198,791
1971	4,627	5,211	9,833	63,774.25	53,028	7,456	131,962.72
1972	3,442	5,091	8,184	61,512.2	53,757.5	4,776	131,393
1973	2,253	5,515	4,922	49,575	24,320	7,450	93,308.6
1974	3,305	3,391	5,837	37,130.5	26,061	4,300	80,559.2
1975	3,436	2,869	6,404	38,652	52,020	4,700	105.338
1976	2,364	3,552	6,079	52,551.6	29,504	4,600	101,025.8
1977	1,964	2,966	5,077	24,879	25,601	4,870	68,727
1978	3,517	1,982	6,612	20,182	20,589	6,206	51,299
1979	3,099	2,139	7,554	11,528	69,612	14,727	101,799
1980	5,527	1,836	11,245	53,418	57,483	5,372	127,288
1981	6,768	4,162	13,851	55,256	172,366	13,863	256,686
1982	10,266	4,613	19,349	133,035	114,805	24,437	292,273
1983	15,835	1,537	33,547	113,554.3	439,992.8	64,789.1	664,891.3
1984	8,389	7,206	34,904	142,488.6	551,863.9	90,107.6	992,977.6
1985	4,353	10,222	29,035	170,022.8	475,736.7	65,802.1	794,099
1986	15,959	13,900	32,097	110,246.86	281,786.04	24,769.64	462,796.44
1987	16,269	7,712	41,568	205,369.2	724,924	54,631.9	1,070,214.4
1988	10,548	10,796	41,994	291,548.7	633,285.2	77,031.8	1,116,338.4
1989	6,856	10,608	36,911	193,135	370,506	39,505	709,178

styles of mineralization being investigated range from broad zones of sulphide-impregnated volcanics to mineralized shear zones and distinct fissure fillings in a variety of geometrical arrangements.

Snodgrass Lake Prospect

The Tandem Resources Ltd.–Storimin Exploration Limited joint venture carried out a further 20000 feet of diamond drilling on their Snodgrass Lake prospect in Moss Township with very encouraging results. Seven of eight holes drilled had one or more ore-grade intersections of gold, the most spectacular being 9.8 feet grading 2.07 ounces gold per ton (hole 176, *see* Table 5.3). This hole was collared 2200 feet east of the underground working. Hole 175 may have intersected the down-plunge extension of the main zone which was explored underground in 1987–1988. This intersection is at a vertical depth of 900 feet. These intersections add to the significance of the mineralization outlined during the course of an underground exploration program carried out in 1987–1988. Storimin Exploration Limited estimates the main zone to contain approximately 250000 tons with a grade of 0.20 ounce gold per ton (Storimin Exploration Limited, 1989 news release). At years end, Central Crude Ltd. optioned this property from the joint venture partners.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office of the Resident Geologist was staffed by M.J. Lavigne Jr., Resident Geologist, and J.F. Scott, Staff Geologist. The Drill Core Library was staffed by P. Sarvas, Drill Core Library Geologist, and D.B. McKay, Assistant Drill Core Library Geologist.

The staff of the Resident Geologist's office handled 850 inquiries, conducted 29 property visits, 3 field trips, and 1 prospecting course. Geological presentations were carried out on 11 occasions. Several projects were also initiated. A field trip guidebook for the Shebandowan greenstone belt is in preparation. A detailed study of the North Coldstream copper mine, northeast of Burchell Lake, and a study on the controls of the distribution of gold in the Marmion Lake batholith, northeast of Atikokan, are under way.

PROPERTY EXAMINATIONS

North Coldstream Mine

The North Coldstream Mine is located at the western end of the Shebandowan greenstone belt, near the northeast shore of Burchell Lake. Production from 1957 to 1967 was 102300000 pounds of copper with minor gold and silver (Northern Miner Press Limited 1969).

Stratigraphically, the mine is located at the upper contact of a felsic metavolcanic pile which is overlain by mafic metavolcanics. This sequence is isoclinally folded about a northeast-trending axis and now is an anticline with the mine being on the southern limb (*see* Figure 5.2). This interpretation is based on half a dozen observations of pillow facings by Giblin (1964) and Hodgkinson (1968). Since the entire area has undergone intense sinistral shearing, the above interpretation must be regarded with caution. This northeast-trending anticline

TABLE 5.2. EXPLORATION ACTIVITY IN THE THUNDER BAY RESIDENT GEOLOGIST'S DISTRICT.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground Work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very Low Frequency

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
1.	Ainsley Financial Corp. Corp.	Powell Lake (Au)	Diamond drilling (612.65 m - 5)
2.	Ainsley Financial Corp. (Whisker Lake Prop.)	Saganagons Lake (Au)	Trenching, sampling
3.	American Platinum Inc. (Angle Bay)	Lac des Iles (Pt,Pd,Cu,Ni)	Diamond drilling (608.9 m - 4)
4.	BHP-UTAH Mines Ltd. (Tommyhow Lake)	Kashishibog Lake (Cu,Zn)	Geological mapping, lithogeochemistry
5.	Bak, David M.	McTavish Township (amy)	Stripping
6.	Bumbu, Costy	Hay Lake (Au,Cu)	Stripping
7.	Chabela Resources Ltd.	Hagey Township (Au)	AEM, Mag
8.	Chaschuk, Metro	Blake Township	Diamond drilling (2000 m - 3)
9.	Coulson, Hugh	Factor Lake	Trenching
10.	Cumberland Resources Ltd.	Henderson Lake (Cu-Zn)	Diamond drilling (881.47 m - 6)
11.	Falconbridge Limited (Hammond Reef)	Marmion Lake (Au)	Geological mapping, diamond drilling (3992 m - 15)
12.	Fern Elizabeth Gold Exploration Ltd.	Bedivere Lake (Au)	Stripping
13.	Fogen, M.	Moss Township (Au)	Stripping
14.	Freeport-McMoRan Gold Company (Corona Option)	Kashabowie Lake (Au)	Diamond drilling (6960 feet - 8), geological mapping
15.	Garden Lake Resources	Garden Lake (Au)	IP, stripping
16.	Gitchee Gumee Gold (Calm Lake Project)	Hepburn Lake (Au)	VLF, Mag, geological mapping
17.	Godzik, Alex	Dawson Road Lots (Au)	Stripping
18.	Goldbrook Explorations Inc.	Boot Bay, Henderson Lake (Au)	AEM, Mag
19.	Golden Myra Resources Inc.	Burchell Lake (Au)	Geological mapping
20.	Grand Oakes Resources Inc. (Sawdo-Davidson)	Crooked Pine Lake (Au)	Geological mapping, trenching, sampling IP, Mag, VLF, Diamond drilling (3080 feet - 10)
21.	Grey Owl Resources	Burchell Lake (Au)	Mag, radiometric
22.	Hayne, William	MacGregor Townshi (Au)	Diamond drilling (32 m - 1)
23.	Home Lake Resources Ltd. (Home Lake)	Powell Lake (Zn,Cu,Au)	Diamond drilling (2500 feet)
24.	Homestake Mineral Development Co.	Saganagons Lake (Au)	AEM, Mag

TABLE 5.2. CONTINUED.

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
25.	INCO Exploration and Technical Services Inc. (Span Lake)	Burchell Lake (Au)	Diamond drilling (2132.54 m)
26.	INCO Exploration and Technical Services Inc. (Stewart Option)	Conmee Township (Au)	Stripping, diamond drilling (988.47 m)
27.	INCO Exploration and Technical Services Inc. (Gold Creek)	Duckworth and Laurie Townships (Au)	Stripping, sampling, diamond drilling (1400 m)
28.	INCO Exploration and Technical Services Inc.	Ware Township (Au)	Trenching
29.	International Platinum Corporation (Superior Prop.)	Crooks Township (Pt,Pd)	Diamond drilling (3592 feet - 1)
30.	International Platinum Corporation (Demars Lake Prop.)	Senga Lake (Pt,Pd)	Diamond drilling (579.3 m - 6)
31.	James Bay Company (Great Lakes Nickel Prop.)	Pardee Township (Ni,Cu,Pt,Pd)	Diamond drilling (14 000 feet - 16)
32.	Johansen, Thorwald	Richardson Lake (Au)	Diamond drilling (36.57 m - 1)
33.	LDR Contracting Inc.	MacGregor Township (Cu-Zn)	Airborne Mag, EM
34.	Lacana Exploration (1981) (East Coldstream Option)	Burchell Lake (Au)	Diamond drilling (561.13 m - 4) (220.37 m - 2)
35.	Lundmark, H.	Conmee Township (Mo,Au)	Stripping
36.	Lundmark, H.	Whitefin Lake (Au)	Mag, VLF
37.	MCS Capital Ltd.	Crooked Pine Lake, Bedivere Lake (Au)	AEM-Mag
38.	MCS Capital Ltd.	Laurie, Blackwell Conacher and Duckworth townships	AEM-Mag
39.	Maki, Mark	Gorham Township (Au)	Stripping
40.	Michelle Gold Mines (Midland Copper Prop.)	Pardee Township (Ni,Cu,Pt,Pd)	Diamond drilling
41.	Mimiska Mining Co. Inc. (Fern-Elizabeth)	Freeborn Township and Miranda Lake (Au)	Decline feasibility study, line cutting (85 km), geological mapping, trenching, diamond drilling (33 250 feet - 65)
42.	Mingold Resources Inc. (Nault Prop.)	Poshkokagan Lake (Au)	Geological mapping, geochemistry
43.	Mingold Resources Inc.	Powell Lake (Au)	Diamond drilling (4000 feet - 12), VLF, Mag, IP, geological mapping, soil geochemistry
44.	Minnova Inc. (Vanguard)	Upper Shebandowan Lake (Cu,Zn,Au,Ag)	Geological mapping, lithogeochem., EM, diamond drilling (3000 m - 10)
45.	Newmont Exploration of Canada Limited (Burchell Lake)	Burchell Lake, Moss Township (Au)	Diamond drilling (1623.6 m - 10)
46.	Noranda Exploration Company Limited	Burchell Lake (Au)	Geology, trenching, diamond drilling (872 m - 7)

TABLE 5.2. CONTINUED.

	Company/Individual (Property Name)	Claim Map Sheet (Commodity)	Exploration Activity
47.	Noranda Exploration Company Limited (Band-Ore)	Conacher Township (Au)	Diamond drilling (364.1 m - 2)
48.	Noranda Exploration Company Limited (Calvert-Wing)	Conacher Township (Au)	Trenching
49.	Noranda Exploration Company Limited	Gorham Township (Au)	Geology, trenching
50.	Noranda Exploration Company Limited	Linklater Lake (Au)	Geology, geochem.
51.	Noranda Exploration Company Limited (Ardeen Option)	Moss Township (Au)	Geology, geophysics, trenching
52.	Noranda Exploration Company Limited (Schoor Option)	Moss Township (Au)	Geology, geochem.
53.	Peterson, Terry et al.	Goldie Township (felds)	Stripping
54.	Placer Dome Inc.	Richardson Lake (Au)	Geological mapping
55.	Premier Lake Resources	Norway Lake (Au)	Stripping, trenching
56.	Rayrock Yellowknife Resources Inc.	Burchell Lake (Au)	Diamond drilling (789.42 m - 7)
57.	Red Fox Resources Ltd. (Red Fox Lake)	Powell Lake (Zn,Cu,Au)	Diamond drilling (2000 feet)
58.	Exploration Rogi Inc. (White Lily Prop.)	Crooked Pine Lake (Au)	Mag, VLF, radiometric, trenching, stripping
59.	Ross, Richard	Titmarsh Lake	Stripping
60.	Skalesky, A.M.	Begin Township (Au)	Power stripping
61.	Smith, Philip D.	Haines Township (Au)	Stripping
62.	Tandem Resources Ltd. and Storimin Exploration Limited (Snodgrass Lake)	Moss Township (Au)	Diamond drilling (10 000 feet - 8)
63.	Total Energold Corporation (Sande-Stewart Option)	Marmion Lake (Au)	Humus geochem., lithogeochemistry
64.	Twomey, Timothy J.	McTavish Township (amy)	Stripping
65.	Calvert, Daniel (River Property)	Oliver-Conmee townships (Au)	Diamond drilling (496 feet - 2)

can be traced from within the boundaries of Quetico Provincial Park for 60 km to the northeast towards Kashabowie. Base metal occurrences are common in this area.

The North Coldstream Mine was last examined by P.E. Giblin (Ontario Department of Mines) in 1961 and is described in Giblin (1964). A study of the North Coldstream Mine was undertaken by M.J. Lavigne Jr. and J.F. Scott in the fall of 1989. An area of 1000 feet by 400 feet, covering the mineralized complex, was mapped at a scale of 1:240 and extensively sampled for whole-rock multielement geochemical analysis and petrographic analysis.

Based on the following observations and combined with other data, this study will proceed under the working hypothesis that the North Coldstream Mine is the stringer zone of a volcanogenic massive-sulphide deposit. Critical support for this hypothesis comprises the following: the ore lenses consist of a high-density network of chalcopyrite and pyrite veinlets; the ore is hosted by a broad zone of pervasive silicification containing disseminated pyrite and chalcopyrite which in turn is sur-

TABLE 5.3. DIAMOND-DRILLING RESULTS ON THE SNODGRASS PROJECT, TANDEM RESOURCES LTD.-STORIMIN EXPLORATION LIMITED, 1989.

Hole Number	Footage	Core Length (ft.)	Gold (oz./ton)
88-169	893-917	24	.24
	1101-1106	5	.166
88-170	688-709.4	21.4	.208
	911.926	15	.09
89-172	888-899	11	.32
89-174	247-257	10	.193
	422.4-446	23.6	.164
89-173	630.9-639	8.1	.091
89-175	1106-1126	20	.334
89-176	793.8-803.6	9.8	2.09

rounded by chlorite alteration; the gold tenor is typical for volcanogenic massive-sulphide (VMS) deposits, 450 ppb (0.013 ounce gold per ton).

The resolution of the genesis of this deposit is hindered by intense deformation which resulted in pronounced schistosity and the obliteration of primary textures necessary for rock identification. Based on mapping by Giblin (1964), this ore complex is sandwiched between a gabbroic intrusive and mafic metavolcanics. This intrusive is located at the regional contact between the felsic metavolcanics and the mafic metavolcanics (*see* Figure 5.2). The gabbroic intrusive has undergone deformation along its margins only, suggesting late to posttectonic emplacement. Mapping by the authors and an examination of underground plans and sections have indicated the presence of a sericite schist in between the intrusion and the ore complex. Fragmental textures observed on surface are suggestive of a felsic volcanic breccia. Thus, the silicified zones hosting the ore may in fact be sandwiched in between felsic and mafic metavolcanics. To date, it cannot be resolved whether the silicified rock is a mafic or felsic metavolcanic. Variations in the colour of the silicification—white, mauve and buff—were treated as mappable units. These colour differences may reflect the composition of the rock that was silicified and may possibly be distinguished by whole-rock geochemistry.

The silicified zone is massive in appearance, although in thin section Giblin (1964) observed layering as being the result of grain-size changes. Host-rock schistosity wraps around the main silicified zone and smaller silicified pods resulting in boudins. The silicification is interpreted to be predeformation and this supports the arguments that this mine is the stringer zone of a volcanogenic massive-sulphide deposit.

Home Lake Cu-Zn Occurrence

The Home Lake Cu-Zn occurrence was discovered in 1965 by F.R. Harris during the course of an Ontario Department of Mines and Northern Affairs regional-mapping program (Harris 1970). It is located 35 km southwest of the North Coldstream Mine, at approximately the same stratigraphic level that the mine is at, within felsic metavolcaniclastics (*see* Figure 5.2). The mineralized zone can be traced for 100 m along the lakeshore and consists of a 2 m wide band of poorly bedded tuffaceous chert. The mineralization consists of pyrite, pyrrhotite, chalcopyrite and sphalerite. A five-foot chip sample taken by Harris (1970) contained 1.24 percent Cu and 0.24 percent Zn.

Home Lake Resources Ltd. carried out a 2500-foot diamond-drilling program in March and April of 1989. This program encountered several other mineralized zones, the best result being 3.7 percent Zn over 6.5 feet, only 100 feet within the stratigraphic footwall of the discovery zone on surface. As seen on surface and as mapped by Harris (1970), the wall rock immediate to the discovery zone is a felsic tuff. Recent drilling, however, found that the dominant lithology to the northwest comprises epiclastic rocks, such as argillite, greywacke and very minor conglomerate (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

DRILL CORE STORAGE PROGRAM

In 1989, the Thunder Bay Drill Core Library was staffed by P. Sarvas (Drill Core Library Geologist), P. Hinz (Assistant Drill Core Library Geologist, January to April), D. McKay (Assistant Drill Core Library Geologist, May to December), A. White (Receptionist, January to September) and G. Coutts (Summer Assistant, July to August). Staff activities were supervised by M.J. Lavigne Jr. (Thunder Bay Resident Geologist).

The Thunder Bay Drill Core Library collects drill core from the Thunder Bay Mining Division, which encompasses three Resident Geologist districts: Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo.

Much of the drill core presently stored at the library is from early-phase diamond-drill exploration projects for metallic minerals. Most of this material has been donated by or solicited from mining companies, exploration companies and prospectors, or has been collected from old drill-core storage sites of abandoned properties. Drill core from industrial-mineral exploration projects, underground drilling at producing or past-producing mines, and the bedrock portions derived from overburden and geotechnical drill projects are also stored at the library.

As of November 30, 1989, 98825 m of drill core are stored at the Thunder Bay Drill Core Library. Some of this material is still under a period of confidentiality. Drill core available for public examination includes 29640 m from 61 properties in the Thunder Bay Resident Geologist's District (*see* Table 5.5).

In 1989, 10300 m of drill core from 30 properties were collected, stored and catalogued at the Thunder Bay Drill Core Library. Of these 30 properties, 22 are gold properties, 6 are base metal properties and 2 are platinum group metal properties. Table 5.3 lists locations, number of drill holes and drill-core footages for

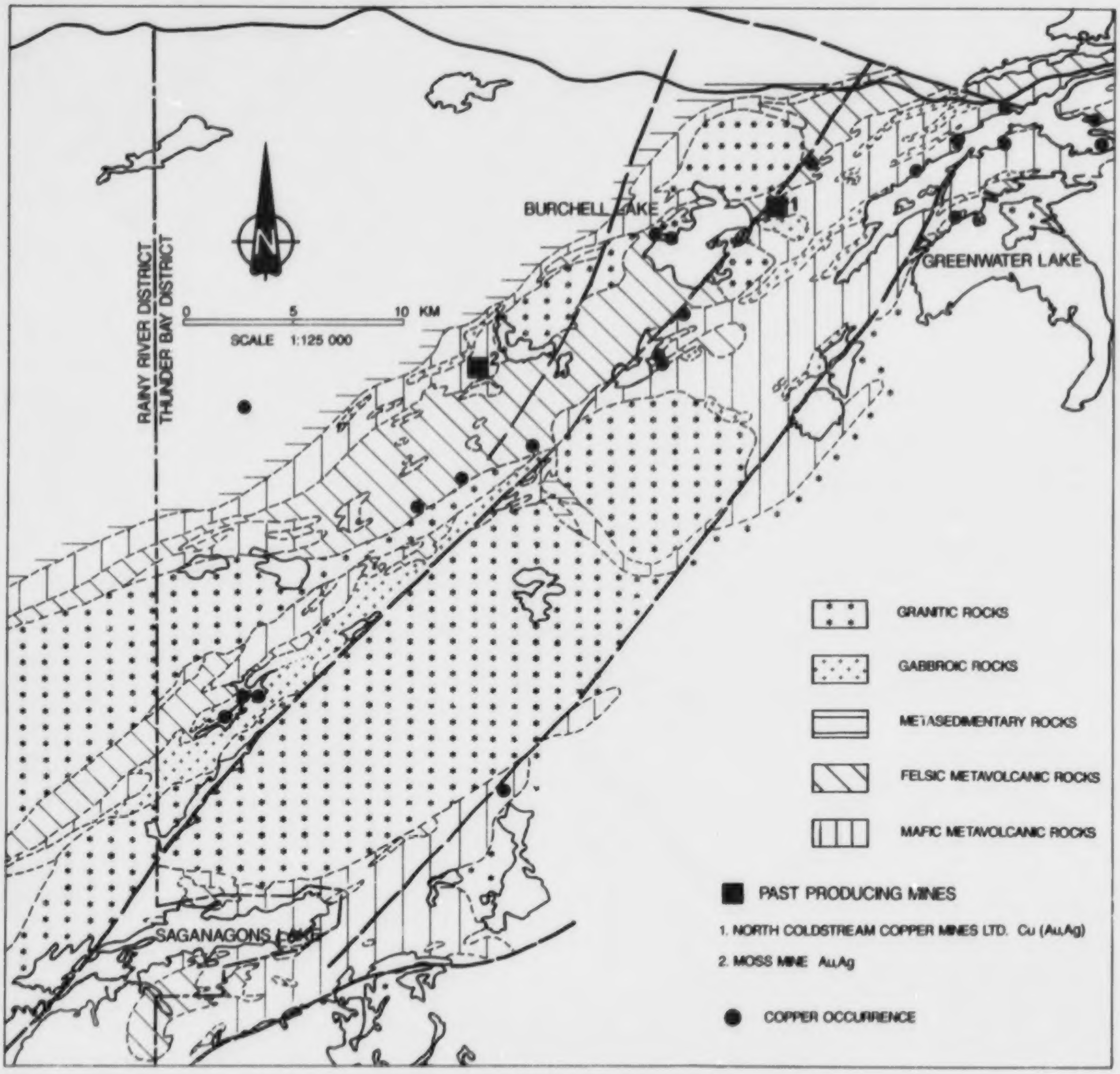

BURCHELL LAKE
GREENWATER LAKE
SAGANAGONS LAKE
RAINY RIVER DISTRICT
THUNDER BAY DISTRICT
N
0
5
10 KM
SCALE 1:125 000
1
2
GRANITIC ROCKS
GABBROIC ROCKS
METASEDIMENTARY ROCKS
FELSIC METAVOLCANIC ROCKS
MAFIC METAVOLCANIC ROCKS
PAST PRODUCING MINES
1. NORTH COLDSTREAM COPPER MINES LTD. Cu (Au,Ag)
2. MOSS MINE Au,Ag
COPPER OCCURRENCE

Figure 5.2. Geology and copper occurrence distribution of the western part of the Shebandowan greenstone belt.

those properties located in the Thunder Bay Resident Geologist's District.

Below are brief descriptions of two properties from which drill core was collected in 1989.

Rio Tinto Canadian Exploration Ltd., Burchell Lake Area

Following an airborne geophysical survey, Rio Tinto Canadian Exploration Ltd. conducted a seven-hole drill program in 1978 to test magnetic and electromagnetic anomalies in the Burchell Lake area. Material from this drill program was never submitted for assessment credit.

In 1988, prospector M. Fogen donated 494 m of drill core from six of the seven drill holes to the Thunder Bay Drill Core Library, and Rio Algom Exploration Inc. donated the drill logs from its archives.

The seven holes are located on a property in the Burchell Lake area, 110 km west of Thunder Bay, between Fountain Lake and Squeers Lake. This property is 7 km south of the North Coldstream Mine (*see* Property Examinations). The drill holes have bearings in the range of 315° and 360° and dips of 50° north.

The drill holes intersect felsic ash tuffs, crystal tuffs and agglomerates, intermediate tuffs and flow rocks, cherts and subordinate gabbro and diabase. One hole contains a 125-foot section of serpentinized peridotite.

The tuffaceous rocks generally contain garnet porphyroblasts and chlorite, biotite, carbonate and epidote seams. Mineralization consists mainly of pyrite and pyrrhotite, disseminated and in thin seams, with many narrow zones of significant (greater than 10 percent) sulphide mineralization. One hole contains a six-foot section consisting of 20 percent pyrite and 5 percent pyrrhotite.

Butte Resources Limited, Sande–Stewart Property, Sawbill Bay

The Sande–Stewart property is located near the east end of Lynxhead Bay in the Sawbill Bay area, Marmion Lake, 23 km northeast of Atikokan and 180 km west of Thunder Bay (*see* Figure 5.1 and Table 5.2). The original occurrence, a mineralized breccia zone, was discovered in 1986 by prospectors D. Sande and E. Stewart.

The property is underlain by rocks of the Marmion Lake batholith: tonalite, granodiorite, diorite, gneiss, quartz-sericite schist, metavolcanic xenoliths and mafic dikes (Fenwick 1976). The Sande–Stewart occurrence is described by Patterson et al. (1987).

From 1987 to 1988, Butte Resources Limited carried out an exploration program consisting of stripping and trenching, an airborne geophysical survey, line cutting, geological and geophysical surveys and diamond drilling. The 1988 drill program consisted of 13 holes totalling 2367 m. With the exception of four drill holes, all have bearings of 360° and dips of 45° north (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

In 1989, prospectors D. Sande and E. Stewart donated 720 m of drill core from four holes to the Thunder Bay Drill Core Library.

In the summer of 1989, Total Energold Corporation collected a number of grab samples from throughout the Sande–Stewart property. The company processed a 23 kg composite sample from the mineralized breccia zone. Five splits were taken from this composite sample and each split was assayed twice. The ten assays from the composite sample returned an average grade of 0.24 ounce gold per ton (J. McPherson, Total Energold Corporation, personal communication, 1989).

Anomalous gold intersections from Butte Resources Limited drill program are listed in Table 5.4.

Anomalous gold values in the drill core are associated with deformation zones (Figure 5.3) and zones of intense alteration. Alteration consists of silicification, carbonatization, hematitization, sericitization and chloritization. Pyrite is ubiquitous, and comprises less than 5 percent of mineralized sections; minor galena, molybdenite, magnetite and visible gold may also be present.

TABLE 5.4. DIAMOND-DRILLING RESULTS ON THE SANDE–STEWART PROPERTY, MARMION LAKE, BUTTE RESOURCES LIMITED, 1988.

Hole Number	Drill Section (m)	Gold (oz./ton)
1	10.6–12.2	0.70
	--13.4---	visible gold
	15.9–17.1	0.06
	24.4–25.6	0.02
	127.1–128.0	0.02
2	107.0–108.6	0.03
5	62.8–63.8	0.04
	157.6–158.7	0.06
	177.1–178.3	0.02
	179.6–181.3	0.02
	183.6–184.9	0.02
8	48.6–51.1	0.05
9	29.7–30.8	0.02
10	3.7–5.1	0.10
	21.9–23.1	0.08
	123.4–124.0	0.06
11	132.9–133.8	0.02
	135.8–136.7	0.08

(Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay)

Figure 5.3 is a drill plan of selected drill holes with deformation zones and sections of anomalous gold values projected to the surface. The drill holes intersect at least two deformation zones on the Sande–Stewart property. The persistent North Deformation zone is intersected by eight of the nine drill holes shown on the drill plan. The zone strikes at approximately 080° to 085° and dips moderately toward the south. Drill-core intersections range from 4.5 to 17 m in width, although it is apparent that the drill holes intersect the North Deformation zone at oblique angles. The North Deformation zone is characterized by a transitional deformation style from predominately brittle in its northeast end to predominately ductile in its southwest end (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The South Deformation zone is not as clearly defined as the North Deformation zone (Figure 5.3). The South Deformation zone includes the original Sande–Stewart occurrence; however, only four of nine drill holes apparently intersect this zone. The structural trend of the South Deformation zone is difficult to interpret. Where the zone is exposed on surface, structural measurements suggest a strike between 110° and 120° and a dip between 55° and 60° south (Patterson et al. 1987). On the other hand, drill intersections suggest a strike of approximately 090° (Figure 5.3). The South Deformation zone is characterized by predominantly brittle deformation.

Brittle deformation is represented in drill core by angular, variably altered, variably oriented fragments of all lithologies cemented by at least two generations of quartz. Ductile deformation is represented in drill core by strong foliation, intense alteration (sericite, carbonate, hematite, chlorite and silica) and tight, asymmetric folding and crenulation of structural planes (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

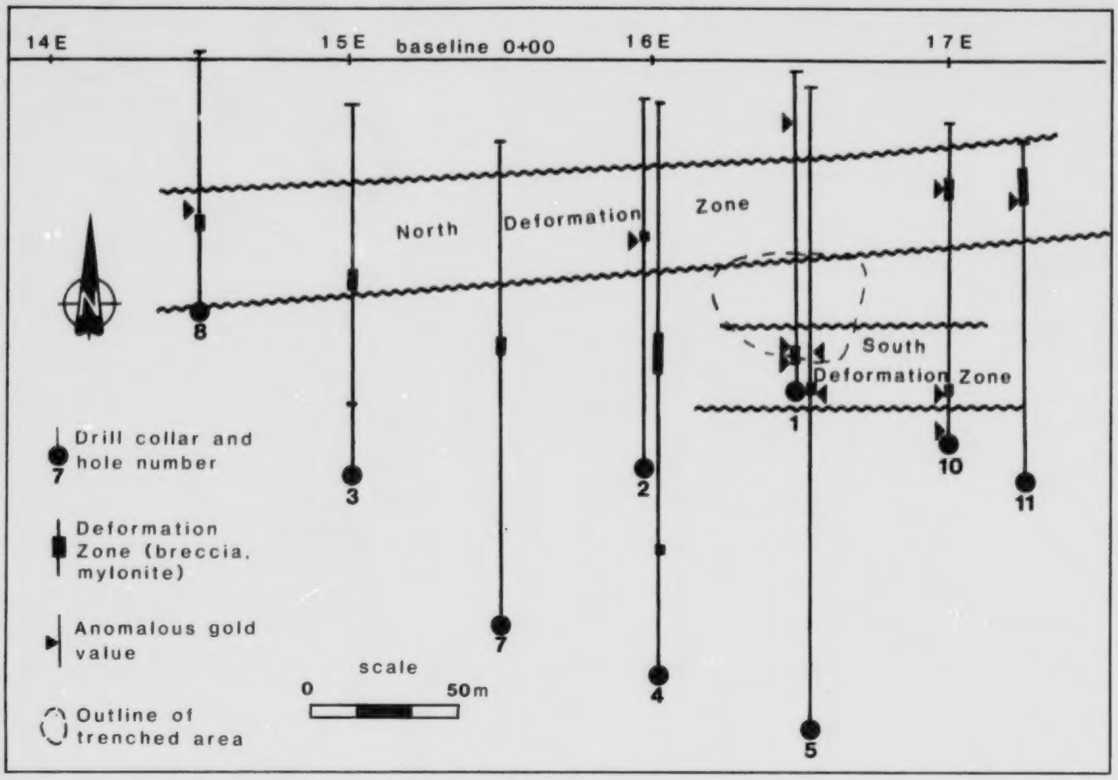


Figure 5.3. Drill plan of selected drill holes, Butte Resources Limited, Sawbill Bay area, Marmion Lake. Deformation zones and sections of anomalous gold values in drill core are projected to the surface (from data in Resident Geologist's Files, Ontario Ministry of Northern Development and Mines, Thunder Bay).

There is a strong correlation between brittle deformation and gold mineralization. This is immediately apparent in the North Deformation zone (Figure 5.3). Drill core from the brittlely deformed northeast end of the North Deformation zone in Holes 2, 5, 10 and 11 all contain sections of anomalous gold values; drill core from the plastically deformed southwest end of the North Deformation zone contains no anomalous gold sections.

In order to fully understand the structural controls of gold mineralization on the Sande-Stewart property, a detailed structural investigation is required. Preliminary results indicate the presence of at least two deformation zones with associated gold mineralization. These zones may represent *en échelon* dilation structures or oblique shear veins related to a regional shear zone. Such a model could explain two features: 1) transitional and apparently penecontemporaneous brittle and ductile deformation within the North Deformation zone and; 2) the difference between strike of structural planes measured on surface (110°) and apparent strikes of the North and South deformation zones as indicated by drill-hole intersections (080° to 090°).

RECOMMENDATIONS FOR EXPLORATION

SHEBANDOWAN GREENSTONE BELT

The Shebandowan greenstone belt contains numerous base metal occurrences that have volcanogenic massive-sulphide characteristics. In addition to the Home Lake occurrence and the North Coldstream Mine described in the Property Examinations section, the Vanguard occurrence—a massive pyrite lens with sphalerite and chalcopyrite—lies within the same stratigraphic interval, northeast of Burchell Lake, near the community of Kashabowie. These occurrences are associated with a 4 to 6 km wide belt of felsic metavolcanics which can be traced for at least 60 km (*see* Figure 5.2). This area has a high density of base metal occurrences in comparison to the rest of the Shebandowan greenstone belt. Within this felsic metavolcanic package, a horizon of felsic metavolcanic fragmentals containing pyritic clasts has been delineated in close proximity to these base metal occurrences.

It is likely that an exhalative massive sulphide was generated in association with the North Coldstream

TABLE 5.5. DRILL CORE STORED AT THE THUNDER BAY DRILL CORE LIBRARY, 1989.
Unless otherwise noted, Table 5.5 lists properties in the Thunder Bay Resident Geologist's District from which drill core was collected during the period from December 1, 1988, to November 30, 1989. *See* Figure 5.2 for property locations.

	Company/ Individual	Property/ Location	Year Drilled	Number of Holes	Metres of Core Stored
1)	Ashton Mining Ltd.	Marr Lake Redhorse Lake	1989	3	235
2)	Butte Resources Ltd.	Sande-Stewart Sawbill Bay	1988	4	720
3)	Johansen, T.	Richardson Lake	1989	1	36.5
4)	Curran Bay Resources Ltd.	Saganaga Lake Saganagons Lake	1984	5	127
5)	Falconbridge Nickel Mines Ltd.	Snodgrass Lake Moss Township	1974–75	14	856
6)	Rio Tinto Canadian Exploration Ltd.	Burchell Lake Burchell Lake	1978	6	494
7)	Chaschuk, M.	Blake Township	1989	1	625
8)	INCO Gold Company	Calvert-Wing Conmee Township	1988	4	696
9)	Moore, P.	Oliver Township	1989	2	85
10)	Canamax Resources Inc.	Max Creek Max Lake	1987	4	254
11)	International Platinum Corp.	Lac des Iles Lac des Iles	1988	1	239
+12)	Butte Resources Ltd.	Jack Lake Sapawe Lake	1988	7	855
+13)	Curran Bay Resources Ltd.	Saganaga Lake Saganagons Lake	1988	10	144
+14)	Rio Tinto Canadian Exploration Ltd.	Conwest Option Henderson Lake	1981	4	532
+15)	New Jersey Zinc Exploration Co. (Canada) Ltd.	Lett Occurrence Linklater Lake	1981	1	16
•16)	Noranda Exploration Company Ltd.	Stewart Property Conmee Township	1985 to 1987	38	2234
•17)	Equinox Resources Ltd.	Lac des Iles Lac des Iles	1988	2	594
•18)	Discovery West Corp.	Burchell Lake Burchell Lake	1988	14	2229

+Core collected before November 30, 1988, but stored and catalogued in 1989.

•Requested "confidentiality period" expired in 1989.

stringer zone. The location and preservation of this massive sulphide hinges on the interpretation of the intense ductile deformation which has affected the host rocks. Most of the western part of the Shebandowan belt has undergone sinistral ductile deformation which has imparted an almost ubiquitous, northeast-trending schistosity to the rocks. The North Coldstream Mine, however, is located within a zone of strong, east-trending foliation with subhorizontal lineations. The few kinematic indicators found to date indicate dextral ductile shearing in this area. Assuming that stratigraphic tops are south facing, a massive sulphide overlying the North Coldstream stringer zones would be dislocated to the west. This would be further complicated by the possible effect of sinistral shearing which may result in further dislocation in a southwest direction. More structural data from this area is needed to clarify these interpretations.

In summary, the western half of the Shebandowan greenstone belt contains abundant evidence that processes capable of generating volcanogenic massive sulphides were active during volcanism and have generated numerous base metal occurrences. It is very likely that this area contains volcanogenic massive-sulphide deposits.

MARMION LAKE BATHOLITH

An unusual situation occurs near Atikokan with respect to Archean lode-gold deposits. The Marmion Lake batholith, a three billion year old tonalite complex, is the host to at least 15 gold occurrences, including six past producers whose total production was 6000 ounces. All of these gold occurrences are located near the western boundary of the batholith and appear to be associated with northeast-trending shear zones. These deposits and occurrences consist of massive quartz veins in a wide variety of orientations, dominated by northeast trends.

A recent discovery—the Sande–Stewart occurrence—is a departure from the norm (described in the Drill Core Storage Program section). Breccia-hosted gold mineralization may have been an overlooked target type in the batholith and prospecting for this type of mineralization could lead to the discovery of mineralization with attractive widths and grades.

To date, gold mineralization is unknown farther to the east within the Marmion Lake batholith, a batholith which may continue for at least 80 km. Until recently, east-trending breccia-hosted gold mineralization was also unknown. The Marmion Lake batholith, with the exception of its western end, remains largely unstaked and unprospected.

GRAHAM TO HIGHWAY 527 AREA

During the last several years, the area north of Thunder Bay, namely the Whistle Lake–Graham Lake metavolcanic belt and the Max Lake–Rinker Lake metavolcanic belt, have been rejuvenated from a mineral-exploration perspective. Current exploration endeavors range from a preliminary literature search, to general regional reconnaissance surveys, to actual ground acquisition and detailed exploration programs.

Previous exploration in the area was limited to the typical "fly and drill" scenario that was prevalent in the search for base metals at the time (1960–1970). Anomalies that were detected by airborne methods were staked and drilled with minimal ground follow-up work. In light of more recent refined knowledge and updated technology, these areas should be re-evaluated for volcanogenic base metals. Much of the old drilling did in fact intersect possible alteration halos as well as significant (although not ore grade) zinc and copper mineralization.

Although the presence of alteration halos was not specifically recognized in the assessment reports, a review of the drill logs would suggest that alteration halos are present. Past work by Phelps Dodge Corporation of Canada Ltd., Amoco Petroleum Company, Dome Ltd., Hanna Mining, and Steep Rock Iron Mines (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay) indicates that iron-sulphide zones (some as wide as 50 feet) are accompanied by "white mica and siliceous bands", "garnets", "banded acid tuffs", "5-10 percent cordierite", "chlorite-actinolite alteration", and "mottled alterations". Many of the anomalies were tested with only one shallow diamond-drill hole; some were not tested at all. In many cases, only basic reconnaissance-type geological maps were produced. It is probable that many oversights may have occurred in the "fly and drill" frenzy.

Drilling in the eastern and central portions of the Whistle Lake–Graham Lake metavolcanic belt intersected base-metal values that deserve additional exploration. Typical values include 0.17 percent Zn, 0.25 percent Cu, with 0.16 ounce silver per ton and 0.02 ounce gold per ton. Zinc values as high as 0.76 percent are reported (Phelps Dodge DDH150-2). This metavolcanic belt has been interpreted to extend beyond Graham Railway Point.

Prospecting in the late 1930s and again in the late 1960s and early 1970s near Oscar, a CNR siding northwest of Graham Railway Point, located sulphide mineralization in metavolcanic rocks. The mineralization is reported to consist of pyrite, pyrrhotite and chalcopyrite all hosted in "garnetiferous biotite schists" (Tanton 1938).

GARDEN LAKE BELT

Within the last several years, the mineral exploration activity in the Garden Lake belt has increased substantially. Current exploration is directed to re-evaluate older discoveries reported by Phelan (1947) and Stocking (1962) when Little Long Lac and Ruffo Lake Gold Mines conducted mineral exploration in the area. Although the landscape has totally changed since Milne (1964) mapped the area for the Ontario Department of Mines, Milne's is the most recent geological map available for the belt. The published scale of this map is 1:63360; the map is essentially a reconnaissance map that delineates the Garden Lake belt.

Logging by Abitibi-Price, in the last decade, has provided access to most of the Garden Lake belt. Logging activity, more than any other nonmining activity, is responsible for the resurgence of mineral exploration in the Garden Lake belt by providing a means of excellent access.

Gold is the main commodity sought for in the belt, but the base metal potential, especially copper-zinc volcanogenic massive-sulphide deposits, should not be ignored, especially near Ruffo Lake.

The Garden Lake area was briefly visited in the summer of 1989 and several gold occurrences were examined. Quartz veins near Conick Lake have very good potential for gold. Phelan (1947) reported visible gold associated with one of the quartz veins at Conick Lake. This occurrence was visited and examined in 1989. No visible gold was noted although arsenopyrite, pyrite and tourmaline were seen in the quartz veins. The maximum apparent width of the vein was about 45 cm but rarely exceeded 30 cm. The vein system is exposed in a small easterly trending gully cut into the east shore of Conick Lake.

The Conick Lake quartz-vein systems have not been systematically exposed, stripped and sampled in recent times and so their full extent or potential is not known. Based on first impressions, the quartz-vein systems are subparallel to an axial-planar cleavage associated with a fold structure that is exposed, in cross section, along the southeast shore of Conick Lake. Gold values of up to "an average of 0.45 oz./t" were reported from Conick Lake; grab samples assayed as high as 1.23 ounces gold per ton (Phelan 1947).

Phelan (1947) also reported gold and nickel values from the south shore of Garden Lake just west of its outlet. Values of up to 1.46 percent Ni and 0.02 ounce gold per ton are reported in the assessment files. In 1988 and 1989, prospector C. Bumbu and Garden Lake Resources Ltd. retrenched and sampled the major occurrences at Garden Lake. Garden Lake Resources Ltd. is planning a diamond-drill program during the winter of 1989–1990 (C. Bumbu, Prospector, personal communication, November 1, 1989).

A regional shear zone has been identified along the longitudinal axis of the Garden Lake belt. This zone was mapped by previous workers (Phelan 1947; Milne 1964) as a 400 m wide metasedimentary unit within the volcanic assemblage. Where inspected in 1988, J.F. Scott has interpreted this zone to be a shear zone of significant proportions and it represents a good regional target for gold exploration. The zone has not been investigated west of Garden Lake, but has been traced eastward to beyond where Highway 811 crosses the Mooseland River.

The Agar creek gold occurrence is within the regional shear zone described above. It is situated at the west end of Garden Lake near where Agar creek enters Garden Lake. The trenches are located on the south side of a small east-projecting peninsula. Here, quartz-feldspar porphyries grade from fresh, unsheared rock to sericite schist as the core of the zone is approached. The shearing is accompanied by the development of quartz veins, carbonate alteration and pyrite. Quartz veins and carbonate veins form small-scale "ladder" veins within the mineralized zone. Pyrite cubes, 2 to 3 mm in size, are disseminated throughout the alteration zone. Chloritic whisps delineate an anastomosing cleavage within and subparallel to the shear zone. Quartz veins range in colour from glossy white to dull grey; the latter variation may represent silicification, as opposed to fissure filling. Individual veins are not very wide (< 15 cm maximum) but permeate the trenched area. Assays from the trenched area ranged from less than 0.01 ounce gold per ton to 0.26 ounce gold per ton (C. Bumbu, Prospector, personal communication, 1989). A sample collected analyzed 33 ppb Au; copper and zinc values were elevated above background at 690 ppm and 360 ppm, respectively.

The regional shear zone was also inspected in a series of trenches located on what is known as the "Point Claims". This second area is located on the southern shore of Garden Lake on a peninsula that juts into the lake at the narrow section. Here trenching has exposed a section of sheared, sericitized feldspar porphyry. Carbonate alteration and pyrite are also present.

As exposed in the trenches, the sheared porphyry is a buff tan colour and is rust stained. Pyrite crystals form cubes up to 0.5 cm in size. Relict feldspar crystals are still discernible on the weathered surface. Because the shear zone is partly underwater, its full width could not be determined. The area's overburden was stripped by Garden Lake Resources Ltd. the week after the author's visit.

Assays obtained by C. Bumbu on grab samples ran as high as 0.6 ounce gold per ton. One sample collected by the author and analyzed for gold by the Geoscience Laboratories Section, Ontario Geological Survey, yielded 630 ppb Au.

The third area visited within the regional shear zone was located on the east shore of Garden Lake near where the Mooseland River makes its exit. The locale is marked by "S" on Map 2058–West Half (Milne 1964). Here, mafic metavolcanic rocks have been reduced to a rock consisting of crenulated chlorite, carbonate and fuchsite. The area was in the process of being stripped and channel sampled. Nickel values were reported by Phelan (1947) from this locality.

It is postulated that the Mooseland River follows this shear zone eastward. This zone was examined again where it is exposed along a bush road south of the Mooseland River. This road intersects Highway 811 about 1.9 km southeast of where Highway 811 crosses the Mooseland River. This locale is about 13 km east of the Garden Lake outflow.

Here a severely crenulated, feldspar- and biotite-rich rock of unknown origin is exposed on the south side of the bush road, approximately 2 km east of Highway 811. Shearing and crenulation is intense; mylonitic features such as grain-size reduction and ribbon quartz lenses, anastomosing cleavage, folded foliation, porphyroblasts and lozenge-shaped lithons are apparent.

Massive to brecciated pyrrhotite with disseminated pyrite is exposed near Highway 811 approximately 3.2 km southwest of Ruffo Lake. The rock also contains significant amounts of magnetite. In polished samples, host-rock fragments within the sulphide are jet black to dark green and very fine grained. Magnetite occurs as small euhedral crystals on the rim around some of the host rock fragments. The fragments are too fine grained to be identified. Structural measurements were not possible due to the highly magnetic nature of the rock. Samples examined were obtained from a rubble pile, and were not in place, although they are not far removed from their source. The sulphide zone is exposed in the roadside ditch. Analysis of the sulphides yielded trace amounts of gold (19 ppb), zinc (335 ppm), copper (90 ppm) and nickel (66 ppm).

The reader is referred to an excellent reconnaissance map of the area by Sage et al. (1974); the general geology and economic potential is summarized. Mineral occurrences and mineralization in diamond-drill holes are outlined on inset maps. Maps by Pye (1968) and from the Thunder Bay Resident Geologist's Assessment Files should be researched to delineate horizons of base metal potential.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

M. Carter: Regional mapping and study of alkalic rocks in the Shebandowan greenstone belt.

RESEARCH BY OTHER AGENCIES

LAKEHEAD UNIVERSITY ACTIVITIES

S.T. Burgess: The geology and mineralogy of the Silver Mountain Mine (HBSc)

S. Gaudino: Sedimentological processes operative in a glacial deltaic environment, Thunder Bay (MSc)

A.D. MacTavish: The Quetico intrusions (MSc)

R. McEachern: Interpretation of Archean paleoregolith, near Mine Centre (HBSc)

B. Seemayer: Mineralogical and textural characteristics of metapelites and metabasites from portions of the Wawa, Quetico, and Wabigoon subprovinces (MSc)

R. Spark: Magnetic fabrics and petrofabrics along the Quetico–Shebandowan Subprovince boundary (MSc)

M. Watt: Geological controls on Boreal forest dynamics (HBSc)

J.D. Young: Fluid inclusion studies at the Storimin–Tandem Au deposit (HBSc)

OTHERS

B. Cambray (Michigan State University): Tectonics of the Sibley Group

D. Lee (Atomic Energy of Canada Limited): Hydrogeology of the Sibley Basin

SELECTED PUBLICATIONS RECEIVED

Sherlock, R. 1989. A study of the third dimension in the Thunder Bay silver veins: fluid inclusion and stable isotope results; MSc thesis, Lakehead University, Thunder Bay, 180p.

REFERENCES

Fenwick, K.G. 1976. Geology of the Finlayson Lake area; Ontario Division of Mines, Geological Report 145, 86p.

Giblin, P.E. 1964. Geology of the Burchell Lake area; Ontario Department of Mines, Geological Report 19, 39p.

Harris, F.R. 1970. Geology of the Moss Lake area; Ontario Department of Mines and Northern Affairs, Geological Report 85, 61p.

Hodgkinson, J.M. 1968. Geology of the Kashabowie area; Ontario Department of Mines, Geological Report 53, 35p.

Milne, V.G. 1964. Geology of the Garden Lake area, District of Thunder Bay; Ontario Department of Mines, Geological Report 25, 21p.

Northern Miner Press Limited 1969. Canadian Mines Handbook – 1969–1970; Toronto, Ontario, 456p.

Patterson, G.C., Scott, J.F., Mason, J.K., Schnieders, B.R., MacTavish, A.D., Dutka, R.J.A., Kennedy, M.C., White, G.D. and Hinz, P. 1987. Thunder Bay Resident Geologist Area, North Central Region; *in* Report of Activities 1986, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 134, p.72-127.

Phelan, L.G. 1947. Report on the Garden Lake property; Little Long Lac Mines Ltd., unpublished report, Thunder Bay Resident Geologist's Assessment Files (52H 12/SW).

Pye, E.G. 1968. Geology of the Lac des Iles area, District of Thunder Bay; Ontario Department of Mines, Geological Report 64, 47p.

Sage, R.P., Breaks, F.W., Stott, G.M., McWilliams, G.M. and Robertson, D. 1974. Operation Ignace–Armstrong: Obonga Lake–Lac des Iles sheet, District of Thunder Bay; Ontario Division of Mines, Preliminary Map P.963, scale 1:126 720.

Stocking, J.A. 1962. Report of diamond drilling; Ruffo Lake Gold Mines Ltd., unpublished report, Thunder Bay Resident Geologist's Assessment Files (52 H12/SE).

Tanton, T.L. 1938 Report-Ignace sheet, southwest quarter, Kenora District, Ontario; Canada Department of Mines and Resources, Mines and Geology Branch, Geological Survey of Canada, Paper 38-13, 12p.

6. Beardmore–Geraldton Resident Geologist's District—1989

J.K. Mason[1], G.D. White[2], A.A. Speed[3], S. Gaudino[3], P. Sarvas[4] and G. Stott[5]

[1]Resident Geologist, Beardmore–Geraldton Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Beardmore–Geraldton Resident Geologist's Office, Northwestern Region.

[3]Resource Geologist, Beardmore–Geraldton Resident Geologist's Office, Northwestern Region.

[4]Drill Core Library Geologist, Thunder Bay Drill Core Library, Northwestern Region.

[5]Geologist, Precambrian Geology Section, Ontario Geological Survey.

INTRODUCTION

The Beardmore–Geraldton Resident Geologist's office completed its third year of operation since the January 1, 1987, subdivision of the Thunder Bay Mining Division. The Beardmore–Geraldton District is outlined on Figures 6.1a and 6.1b and includes the communities of Beardmore, Jellicoe, Geraldton, Longlac, Nakina, Fort Hope, Lansdowne House, Summer Beaver and Webequie. Exploration activity in the Beardmore–Geraldton Resident Geologist's District during the year was significantly reduced from 1988 levels. Approximately 89 exploration programs, including company and prospector projects, were undertaken in the Beardmore–Geraldton Resident Geologist's District, and 17514 claims were active.

The Ontario Prospectors Assistance Program (OPAP) was implemented on October 6, 1989. Thirty-four prospectors, who have been active in the district, were approved for funding. Ontario Mineral Exploration Program (OMEP) assistance totalling $307684 was also awarded in 1989.

MILLING ACTIVITY

Ateba Mines Inc., who officially opened the Pan-Empire Mill in May 1988, did not operate in 1989 until November. Extensive renovations to mill components were undertaken for most of the year. Gold concentrate from the P. Culhane's MacLeod–Cockshutt cleanup mill in Geraldton was processed within the 200 ton per day Ateba Mines Inc. mill during late 1989.

ADVANCED EXPLORATION AND DEVELOPMENT

Placer Dome Inc. optioned claims covering the Brookbank prospect (Irwin Township) owned by Metalore Resources Limited. Extensive stripping, sampling and diamond drilling of the main zone was conducted. A feasibility study will be undertaken that could include underground development. The Brookbank prospect has geological reserves estimated at 1.3 million tons grading 0.3 ounce gold per ton (Metalore Resources Limited, Annual Report, 1988).

Approximately 200 claims have been optioned by Placer Dome Inc. including the Cherbourg and Foxear properties, both on the Brookbank fault zone.

EXPLORATION ACTIVITY

Levels of exploration activity in the Beardmore–Geraldton area (Wabigoon Subprovince) and the Fort Hope–Miminiska Lake area (Uchi Subprovince) have dropped significantly during 1989. It is estimated by the authors that exploration expenditures were at approximately 60 percent of the dollar-level expenditures of 1988. Approximately 85 percent of exploration dollars were expended for gold exploration and 15 percent were used in the search for base metals and platinum group metals (PGM). Gold exploration was undertaken mainly in the Beardmore–Jellicoe area. Base metal exploration was concentrated in the Marshall Lake, Onaman Lake, Kawitos Lake (Albany River) and Elmhirst Township areas.

Assessment work credit information for the Beardmore–Geraldton Resident Geologist's District is given in Table 5.1 of Lavigne et al. (this volume).

The Thunder Bay Drill Core Library summary (1989), which includes drilling activity in the Beardmore–Geraldton District, is given in Table 5.5 (*see* Lavigne et al., this volume).

Company exploration programs are summarized in Table 6.1.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

Staff of the Beardmore–Geraldton Resident Geologist's District includes J. Mason, Resident Geologist; G. White, Staff Geologist; and C. Komar, Secretary. A. Speed (Resource Geologist) and S. Gaudino (Resource Geologist) staff the Beardmore–Geraldton Historical Research Project, which is funded by the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the

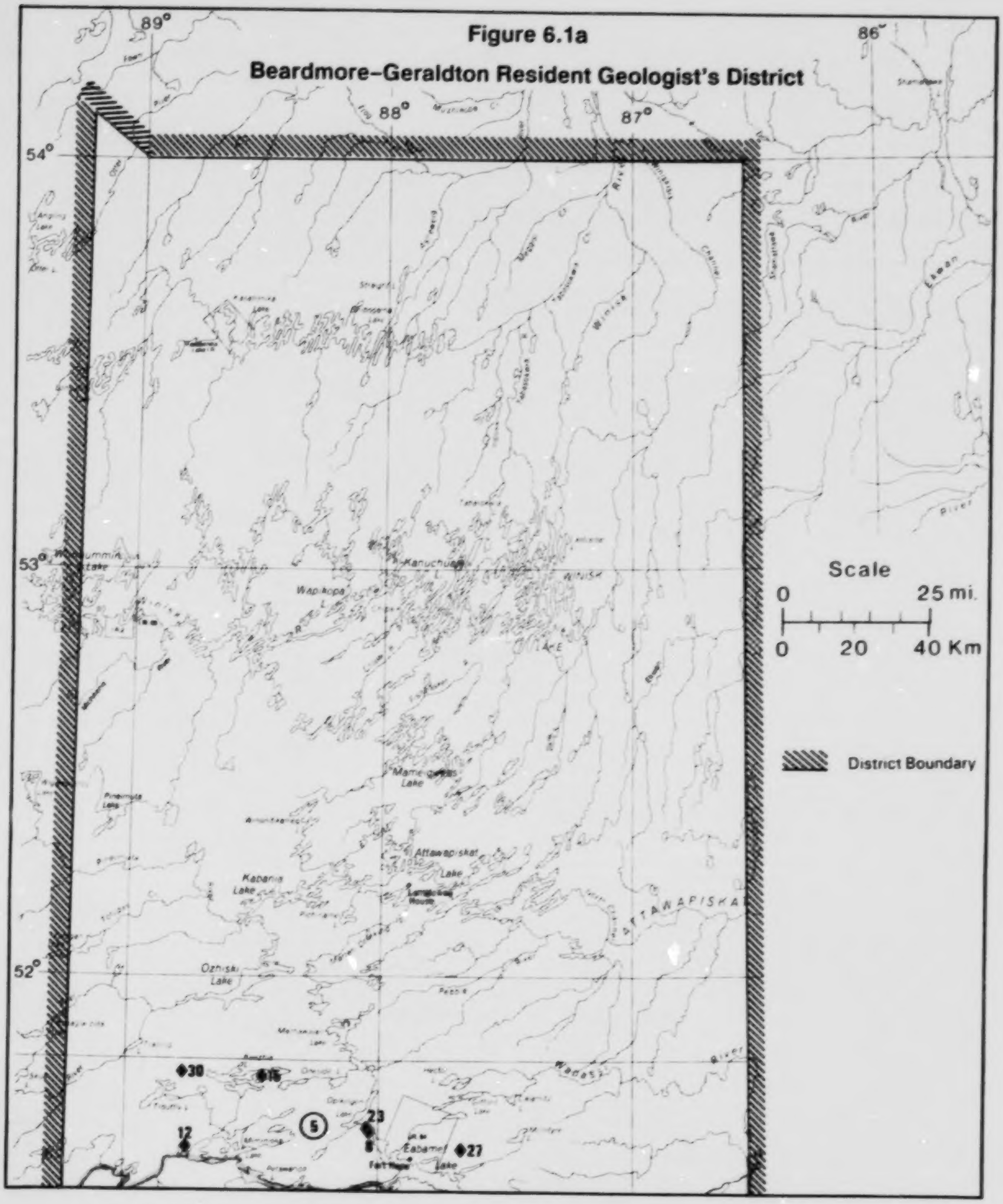


Figure 6.1a

Beardmore–Geraldton Resident Geologist's District

89°
88°
87°
86°
54°
53°
52°
Wunnummin Lake
Wapikopa L.
Kanuchuan L.
Winisk
Mameigwess Lake
Attawapiskat Lake
Kabania Lake
Lansdowne House
ATTAWAPISKAT
Ozhiski Lake
Ekwan
River
Eabamet Lake
30
15
5
23
8
12
27
Scale
0
25 mi.
0
20
40 Km
District Boundary

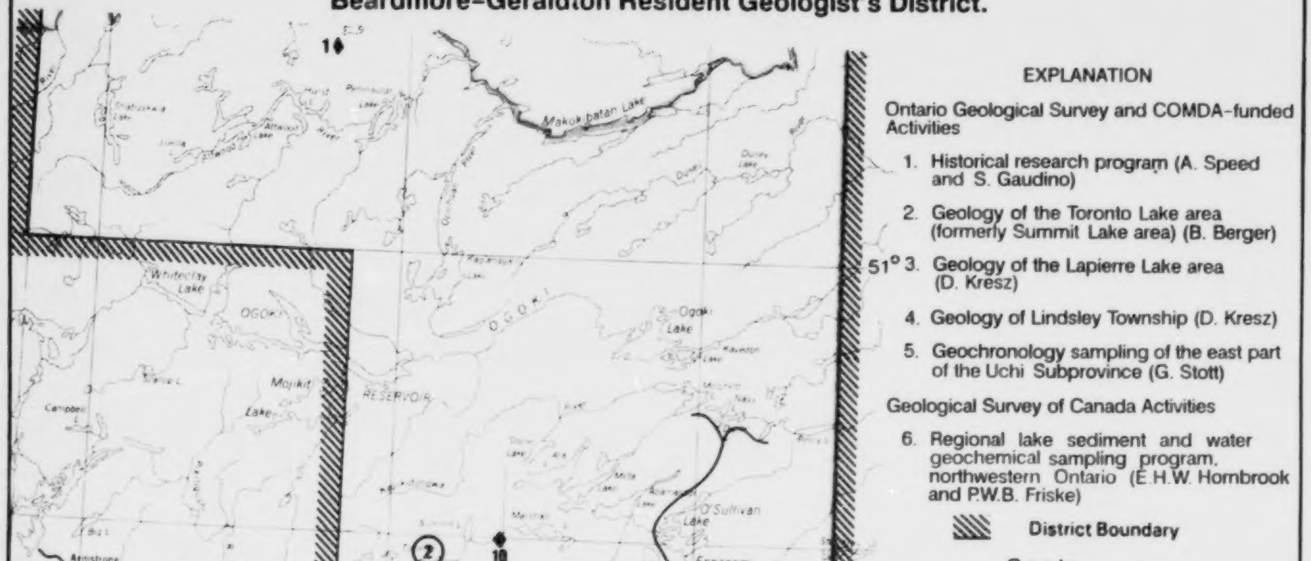
EXPLANATION

◆ Property Visits 1989

1. Boylen Occurrence (S. Parent)
2. Brookbank Prospect (Placer Dome Inc. - Metalore Resources Limited)
3. Colter Lake Property (L. Cox, J. McMahon, M. Rentz)
4. Cox - Onaman River Prospects (N. Cox)
5. East Leitch (Wilport) Prospect (Minerais Anodor Inc. - Falconbridge Limited)
6. Fairloch Lake Property (A. Lafontaine)
7. Fiskar Lake Property (H. Hein)
8. Fort Hope Gold Mine (Ohio Resources Corporation - J. Reid)
9. Gold Fields Road Au Occurrence (T. Johansen)
10. Gripp Lake Prospect (Granges Exploration Ltd.)
11. Hardrock Extension Inc. Prospects (M. Malouf)
12. Howells Lake Prospect (Homestake Mineral Development Company - Baroque Resources Ltd.)
13. Jacobus Prospect (N. Cox)
14. Kenty Au-Mo Prospect (High Frontier Resources Ltd.)
15. KL-12 Occurrence (J. Ternowesky, J. Hinzer)
16. Lofquist Occurrence (H. Goodman Jr.)
17. McFarlane-Manion Occurrence (G. Milks, C. Paul)
18. Milestone-Kengate Occurrence (Orient Resources)
19. Missing Link Occurrence (N. Cox)
20. Missing Link - Western Extension Property (M. Nelson)
21. Morgan Occurrence (Golden Dragon Resources Ltd. - Glen Auden Resources Limited - Denison Mines Limited)
22. Oakes Twp. - Isis Lake Property (B. Brinklow, R. Brinklow)
23. OL-29 Occurrence (Noramco Mining Corporation)
24. Pagwa Occurrence (J. Shields, M. Swereda)
25. Partridge Lake Occurrence (F. Checkley)
26. Rentz Occurrence (Golden Dragon Resources Ltd. - Glen Auden Resources Limited - Denison Mines Limited)
27. Reserve Creek Prospect (Goldpost Resources Inc.)
28. Savage - Leduc Occurrence (J. Savage, L. Savage)
29. Standingstone - Archie Lakes Occurrence (Placer Dome Inc.)
30. Talbot Lake Prospect (Placer Dome Inc.-Golden Crescent Resources Corp.)
31. Theresa Gold Mine (Duration Mines Ltd.)
32. Vivian Township Property (Zygote Resources)
33. West Long Lake Property (B. Brinklow, R. Brinklow)

Figure 6.1b.

Beardmore-Geraldton Resident Geologist's District.


Makokibatan Lake
Whiteclay Lake
OGOKI
Mojikit Lake
RESERVOIR
Ogoki Lake
O'Sullivan Lake
Esnagami Lake
Armstrong
Onaman Lake
LAKE NIPIGON
EL 261 m
GERALDTON
Long Lake
Caramat
Hillsport
51°
50°
89°
88°
87°
86°
1
2
3
4
6
10
13
14
17
18
19
20
22
24
25
29
31
32
33

EXPLANATION

Ontario Geological Survey and COMDA-funded Activities

1. Historical research program (A. Speed and S. Gaudino)
2. Geology of the Toronto Lake area (formerly Summit Lake area) (B. Berger)
3. Geology of the Lapierre Lake area (D. Kresz)
4. Geology of Lindsley Township (D. Kresz)
5. Geochronology sampling of the east part of the Uchi Subprovince (G. Stott)

Geological Survey of Canada Activities

6. Regional lake sediment and water geochemical sampling program, northwestern Ontario (E.H.W. Hornbrook and P.W.B. Friske)

▨ District Boundary

Scale
0 — 25 mi.
0 — 20 — 40 Km

TABLE 6.1. EXPLORATION PROGRAMS FOR THE PERIOD JANUARY 1, 1989, TO NOVEMBER 30, 1989.

ABBREVIATIONS

AEM	Airborne electromagnetic survey	IP	Induced polarization survey
AMag	Airborne magnetometer survey	Mag	Magnetometer survey
ARad	Airborne radiometric survey	Res	Resistivity survey
DDH	Diamond-drill hole	Rad	Radiometric survey
EM	Electromagnetic survey	UG	Underground work
HL-EM	Horizontal-loop electromagnetic survey	VLF	Very Low Frequency

	Company	Township/Area	Exploration
1)	Atlantic Mining Corporation	Irwin, Pifher townships	Geochemistry
2)	Beardmore Goldstake	Metcalfe Lake	AEM, AMag
3)	Bellhaven Resources Inc.	Irwin Township	VLF-EM, Mag, Linecutting
4)	Bellhaven Resources Inc.	Ledingham Lake	VLF-EM, Mag
5)	Blue Falcon Mines Ltd.	Legault Township	VLF-EM
6)	Brinklow, Barbara	Oakes Township	Trenching, Geochemistry
7)	Brinklow, Lonnie	Oakes Township	Trenching, Geochemistry
8)	Brinklow, Rachel	Coltham Township	Geochemistry, VLF, Linecutting
9)	Brinklow, Rachel	Oakes Township	Trenching, Geochemistry
10)	Brinklow, William	Oakes Township	Trenching, Geochemistry
11)	Bruce, Gerald J.	Leduc Township	Stripping
12)	Bumbu, Costy	Colter Township	Stripping, Trenching
13)	Byron, Frank	O'Sullivan Lake	Stripping, Trenching, Geochemistry
14)	Callisto Minerals Incorporated	Metcalfe Lake	Geology
15)	Canadian Gold Resources Inc.	Leduc Township	Stripping
16)	Canadian Gold Resources Inc.	Walters Township	Mag, VLF-EM
17)	Checkley, Fred	Legault Township	Stripping
18)	Codeka Inc.	McComber, Irwin, Summers townships	AEM, AMag
19)	Cominco Ltd.	O'Sullivan Lake	Geophysics
20)	Cote, Robert	Ledingham Lake	Stripping
21)	Cox, Nolan	Elmhirst Township	Stripping
22)	Cox, Nolan	Irwin Township	Stripping
23)	Cox, Nolan	Lapierre Township	Stripping
24)	Cox, Nolan	Onaman River	Stripping
25)	Douglas, Arthur	Kowkash Township	Prospecting
26)	Fayle, Richard and Lassila, Pentti	Castlewood Lake	Linecutting, Stripping, Trenching, Mag, Geochemistry
27)	Flint Rock Mines Ltd.	Ashmore Township	Mag, VLF-EM
28)	Freewest Resources Inc.	Kowkash Township	Stripping, Trenching, VLF-EM
29)	GLM Exploration Services	Walters Township	Linecutting, Geophysics, DDH
30)	Goldbrook Explorations Inc.	Lapierre, Rickaby townships	AEM-VLF, Mag

TABLE 6.1. CONTINUED.

	Company	Township/Area	Exploration
31)	Golden Dragon Resources Ltd.-Glen Auden Resources Limited-Denison Mines Limited	Summers, Eva, Kitto townships	Stripping, Geochemistry, Linecutting, Geology, Trenching, VLF, Mag, IP, AEM
32)	Goodman, Herb Jr.	McComber Township	Stripping, Trenching, Geochemistry
33)	Granges Exploration Ltd.	Marshall-Gripp Lakes	Stripping, Geology, Mag, IP, HL-EM Geochemistry, DDH, Linecutting
34)	Hardrock Extension Inc.	Ashmore Township	Stripping
35)	Head, Thomas	Fernow Township	Stripping, Trenching
36)	Head, Thomas	Treptow Lake	Trenching
37)	Hein, Harold	Squaw Lake	Stripping, Trenching
38)	Andaurex Resources Inc.-High Frontier Resources Ltd.	Conglomerate Lake	Stripping, DDH
39)	Homestake Mineral Development Company	Oboshkegan Township	Stripping, Mag, VLF-EM
40)	Johansen, Thorwald	Errington Township	Stripping, DDH
41)	Koski, John	Onaman River	Stripping, Trenching
42)	Maki, Neil R.	Vincent Township	Stripping
43)	Metalore Resources Limited	Irwin Township	DDH, Linecutting
44)	Minerais Anodor Inc.-Falconbridge Ltd.	Summers Township	Stripping, Trenching, Geology, Geochemistry, DDH
45)	Mingold Resources Inc.	Colter Township	DDH
46)	Mingold Resources Inc.	Eva Township	Geology, Geochemistry, VLF-EM, Mag, DDH
47)	Mingold Resources Inc.	Meta Lake	DDH
48)	Minnova Inc.	Melchett Lake	Geology, Geochemistry
49)	Moore, James H.	Gzowski Township	Trenching
50)	Morning Dew Exploration	Leduc Township Geology,	Linecutting, Geochemistry, Geophysics
51)	Nelson, Ben	Colter, Hipel townships	Linecutting, Stripping, Trenching, EM
52)	Nelson, Myron	Legault Township	Stripping
53)	Noramco Explorations Inc.-Pure Gold Resources Inc.	Opikeigen Lake	DDH
54)	Noranda Exploration Company Limited	Elmhirst Township	Stripping, Geology, Geochemistry
55)	Noranda Exploration Company Limited	Rickaby Township	Linecutting, Geology, Geochemistry Geophysics, Stripping

TABLE 6.1. CONTINUED.

	Company	Township/Area	Exploration
56)	Noranda Exploration Company Limited	Sandra Township	IP, Res
57)	Noranda Exploration Company Limited	Vincent Township	DDH
58)	Norwin Geological Ltd.	Oakes Township	DDH
59)	Ohio Resources Corporation	Rich Lake	Mag, EM
60)	Optrix Radiation Inc.	Walters Township	Mag
61)	Orient Resources	Elmhirst Township	Stripping, Geology, Geochemistry
62)	Parent, Shaun	South Kawitos Lake	Stripping, Trenching, Geology, Geophysics, Geochemistry
63)	Parklane Mines and Minerals Inc.	Summers Township	VLF-EM, Mag
64)	Paul, Charles Milks, Gerald	Gzowski Township	Stripping, Trenching, Geochemistry
65)	Pettit, Cyril	Walters Township	Stripping
66)	Pichette, Arnold	North Onaman River	Trenching, DDH
67)	Pichette, G.	Vincent Township	Stripping
68)	Placer Dome Inc.	Nass-Briarcliffe lakes	Linecutting Geology, Geophysics, DDH
69)	Placer Dome Inc.	Irwin, Sandra, Walters townships	Stripping, DDH, Geochemistry
70)	Placer Dome Inc.	Keezhik Lake	DDH
71)	Placer Dome Inc.	Lamaune Lake	DDH
72)	Placer Dome Inc.	Summers Township	Stripping, Linecutting, Geology, Geochemistry, Geophysics, DDH
73)	Placer Dome Inc.–Golden Crescent Resources Corp.	Talbot Lake	DDH, Stripping, Geochemistry
74)	Primrose Gold Resources Inc.	Elmhirst, Rickaby townships	IP, DDH
75)	Quillo Resources Inc.	Lake St. Marie,	DDH
76)	Quillo Resources Inc.	O'Sullivan Lake	DDH
77)	Roxmark Mines Limited–Ateba Mines Inc.	Errington Township	Geochemistry
78)	Sanfacon, Olympe	Gzowski Township	Trenching
79)	Savage, James	Leduc Township	Trenching
80)	Shields, Jay	Klob Lake	Stripping, Trenching, DDH
81)	Shields, Jay	Pagwachuan Lake Area	Stripping, Trenching, DDH
82)	Starr, Eugene	Dorothea, Eva townships	DDH
83)	Stratmin Inc.	Summers Township	IP, Mag
84)	Tashogan Minerals–Halcyon Resources Ltd.	Tashota Lake	DDH
85)	Teck Exploration Limited–San Paulo Explorations Inc.	Eva, Summers Townships	DDH
86)	Theriault, Ozias	Schist Lake	Geochemistry
87)	Tundra Gold Mines Ltd.	Sim-Morden Lakes	Prospecting
88)	Wilson, Sandy	Ashmore Township	DDH, Stripping
89)	Zygote Resources Ltd.	Vivian Township	Stripping, Trenching, Geology, Geochemistry, VLF-EM

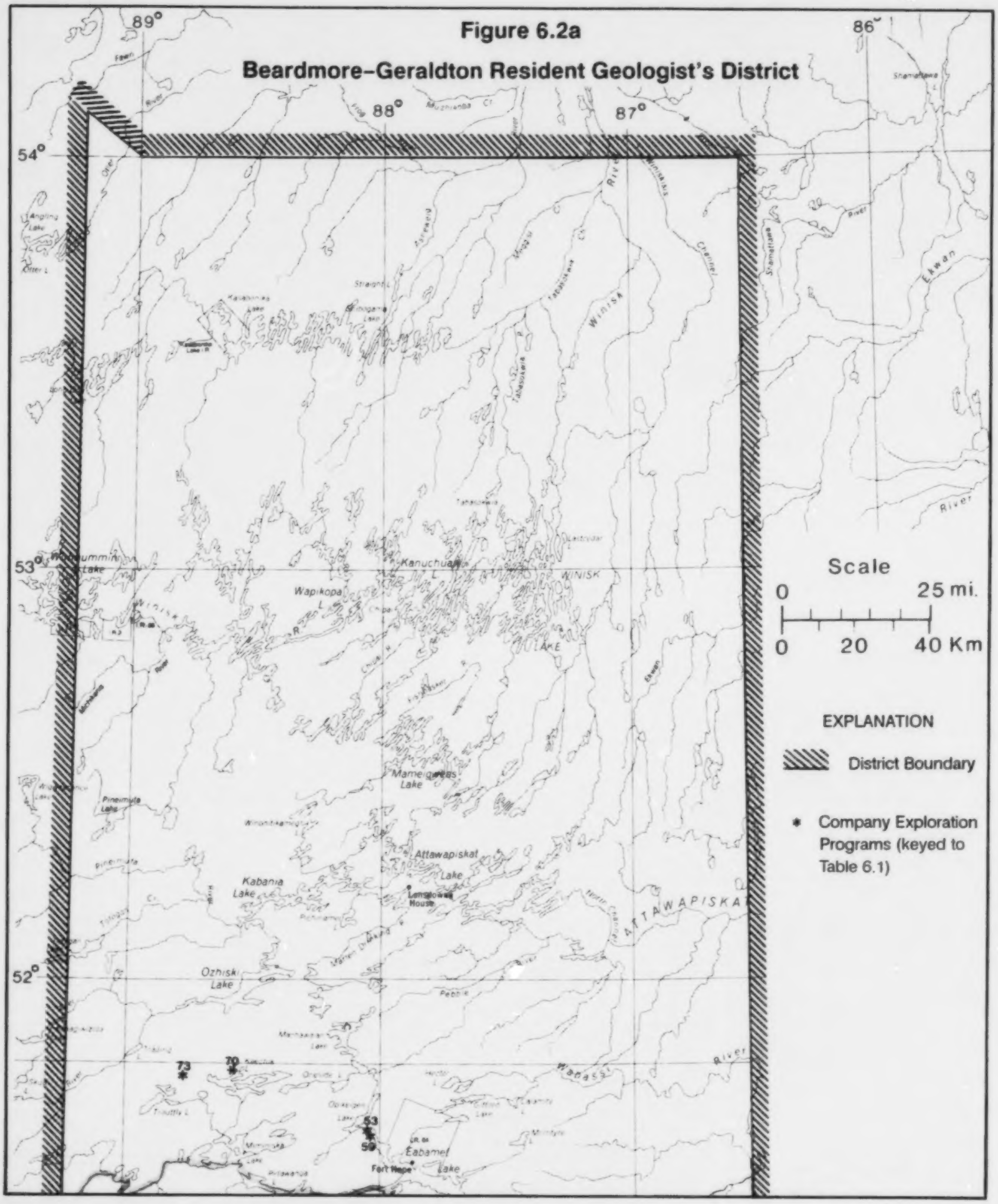


Figure 6.2a

Beardmore-Geraldton Resident Geologist's District

89°
88°
87°
86°
54°
53°
52°
Angling Lake
Otter L
Straight L
Kanuchuan L
Wapikopa L
WINISK LAKE
Winisk River
Winisk
Ekwan River
Shamattawa
Channel
Mameigwess Lake
Pineimuta Lake
Attawapiskat Lake
Lansdowne House
Kabania Lake
Ozhiski Lake
ATTAWAPISKAT
Pebble
Wabassi River
Eabamet Lake
Fort Hope
73
70
53
59
Scale
0
25 mi.
0
20
40 Km
EXPLANATION
District Boundary
Company Exploration Programs (keyed to Table 6.1)

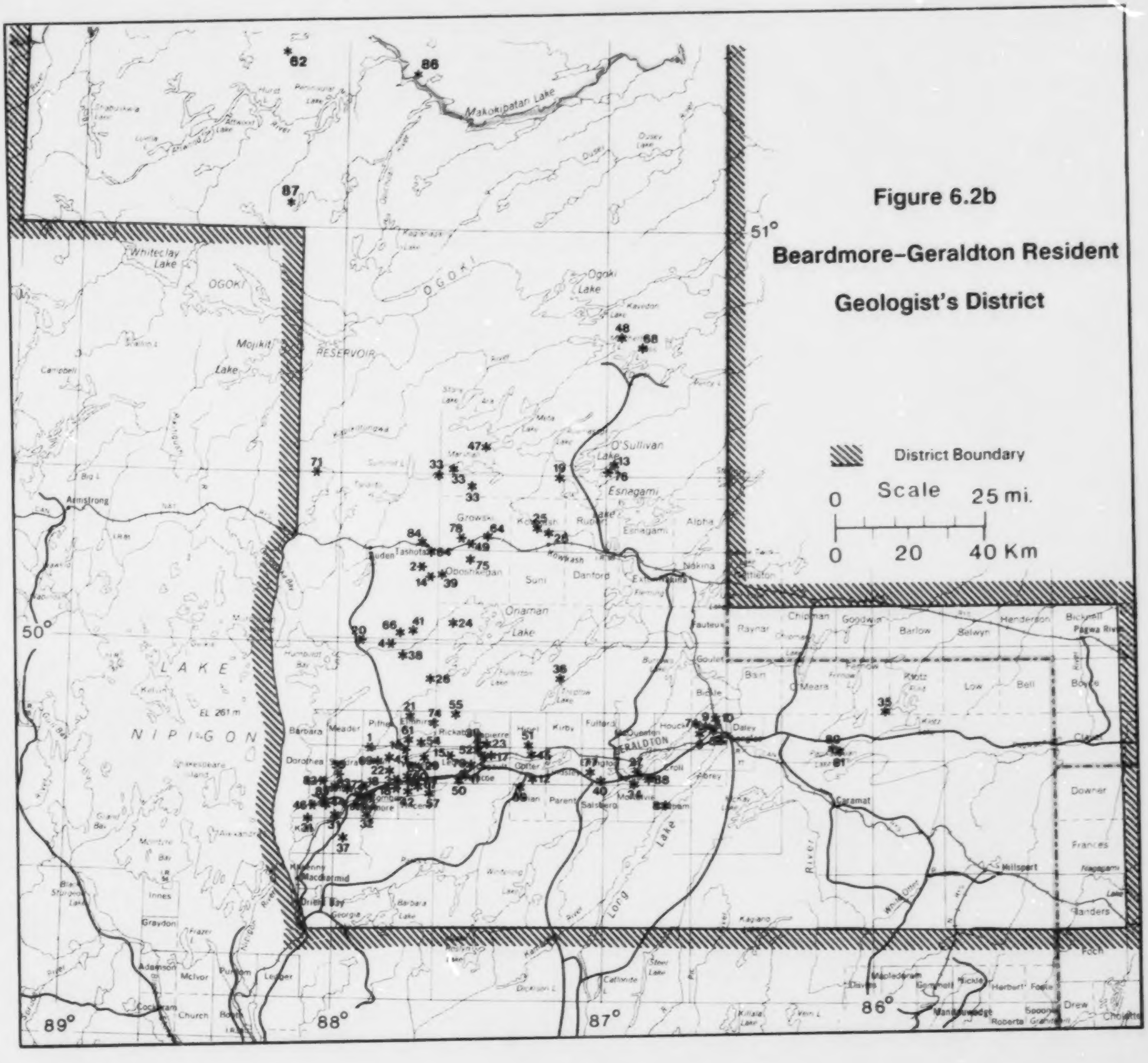


Figure 6.2b

Beardmore–Geraldton Resident Geologist's District

▨ District Boundary
Scale
0 25 mi.
0 20 40 Km
51°
50°
89°
88°
87°
86°
Makokibatan Lake
Whiteclay Lake
OGOKI
Mojikit Lake
RESERVOIR
Ogoki Lake
O'Sullivan Lake
Esnagami
Armstrong
Onaman Lake
LAKE
NIPIGON
EL 261 m
GERALDTON
Long Lake
Caramat
Hillsport
Macdiarmid
Orient Bay
Beardmore
Nakina
Growski
Tashota
Oboshkegan
Suni
Danford
Kowkash
Barbara
Meader
Pifher
Dorothea
Rickaby
Lapierre
Kirby
Fulford
Houck
Daley
Ashmore
Parent
Salsberg
Errington
Pagwa River
Raynar
Chipman
Goodwin
Barlow
Selwyn
Henderson
Bicknell
Bain
O'Meara
Low
Bell
Boyce
Downer
Frances
Randers
Foch
Innes
Graydon
Adamson
McIvor
Purdom
Ledger
Cockram
Church
Kagiano
Davies
Mapledoram
Nickle
Herbert
Foote
Drew
Roberta
Manitouwadge
62
86
87
48
68
47
71
33
19
13
76
25
28
84
78
64
49
75
2
14
39
66
41
24
30
4
38
36
26
35
21
74
55
1
61
51
9
10
7
80
81
22
15
52
23
17
50
57
32
40
34
88
37
46
83

Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

The Beardmore-Geraldton Resident Geologist's staff provided consultation and information to prospectors, mining company geologists, and consultants active in mineral exploration. Property visits, field trips, prospectors classes, geology talks and seminars were also undertaken.

Field offices in Beardmore and Geraldton were established and staffed for the months of May to October on a weekly, part-time basis and intermittently on demand for the winter months. The Beardmore Municipal Office hosts the Beardmore Field Office, and the Ministry of Northern Development and Mines Office in Geraldton serves as the Geraldton Field Office.

Personal consultations totalled 650 people and phone inquiries totalled 346 persons for the Beardmore, Geraldton and Thunder Bay offices.

Three major field trips were given in the Beardmore-Geraldton area to industry personnel. A total of 33 property visits were undertaken.

A compilation of gold occurrences, prospects and deposits of the eastern Uchi Subprovince (Fort Hope-Miminiska Lake area) continued as an ongoing project. Initial geochronology and structural observations were made by the authors and G. Stott, Precambrian Geology Section, Ontario Geological Survey.

Exploration talks were delivered to the Manitouwadge Canadian Institute of Mining and Metallurgy (CIM) Branch and at the Northwestern Ontario Mines and Minerals Symposium in Thunder Bay. Poster displays depicting exploration activity in the district were presented in Toronto, Thunder Bay and Ottawa. A provincial mining and exploration display was cohosted by the senior author at the Cordillera Roundup in Vancouver, British Columbia. The Historical Research program delivered a talk at the Northwestern Ontario Mines and Minerals Symposium in Thunder Bay and presented posters in Thunder Bay and Toronto.

An Advanced Prospecting Course was held in Beardmore. The Resident Geologist and Staff Geologist acted as facilitators utilizing key resource people. A total of 35 prospectors attended the course.

Geological information was inputted into a number of planning issues including suitability of certain lakes for cottage subdivisions (required by the Ministry of Natural Resources, Geraldton) and suitability of exploration activities within the Geraldton Water Supply area.

Staff attended the Prospectors and Developers Convention in Toronto; the Canadian Institute of Mining and Metallurgy's Annual General Meeting, Edmonton; the Geological Survey of Canada's Open House, Ottawa; the Institute for Lake Superior Geology in Duluth, Minnesota; and the Cordillera Roundup, Vancouver, British Columbia.

The senior author attended approximately ten Mining Act Draft Committee Meetings and was a major contributor to the assessment work area of Bill 71 and its accompanying regulations.

PROPERTY EXAMINATIONS

BEARDMORE-GERALDTON AREA

General Geology and Structure

The geology of the Beardmore-Geraldton area's portion of the Wabigoon Subprovince has been divided into two belts: 1) the Beardmore-Geraldton belt, and 2) the Onaman-Tashota metavolcanic belt. The belts are separated by the Paint Lake fault—a major dextral transcurrent fault.

The Beardmore-Geraldton belt is situated within an east-trending, isoclinally folded, metavolcanic-metasedimentary sequence. Lithologic units have been transposed into a series of alternating slices or interleaves of metavolcanics and metasediments within a wrench fault or megashear zone. The Beardmore-Geraldton belt has been subdivided lithologically into 1) the Southern metavolcanic sub-belt, and 2) the Southern metasedimentary sub-belt.

The Onaman-Tashota metavolcanic belt is a felsic to mafic, calc-alkalic and tholeiitic metavolcanic sequence bounded to the south by the Paint Lake fault.

A detailed description of the geology and the gold mineralization of the Beardmore-Geraldton belt and Onaman-Tashota metavolcanic belt is provided in Mason and White (1986) and by Mason and White in Patterson et al. (1984, 1985).

Summers Township Property

Golden Dragon Resources Ltd.-Glen Auden Resources Limited hold a group of 100 contiguous claims termed the Summers Township property. The property is located immediately west of the town of Beardmore in Summers Township. Golden Dragon Resources Ltd. is the property operator and Denison Mines Limited has an option to enter into a joint-venture agreement with Glen Auden Resources Limited and Golden Dragon Resources Ltd. to continue exploration on the property.

The Summers Township property occurs within the Southern metavolcanic sub-belt (part of the main Beardmore-Geraldton belt) which consists of a sequence of massive to pillowed iron tholeiites. A weak to moderately strong fabric and weak, pervasive carbonate alteration is common throughout the Southern metavolcanic sub-belt (Mackasey 1969).

H. Bent (Project Geologist, Robert S. Middleton Exploration Services Inc.) (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay) described the 1989 exploration program and the property:

> "The property was subject to a reconnaissance and detailed mapping program in conjunction with a ground geophysical VLF-EM survey (totalling 75 km) and a limited induced polarization survey over a

> structurally controlled sulphidized zone. A mechanical stripping and channel sampling program of areas of interest followed this initial reconnaissance exploration work. The Morgan showing, a known gold occurrence (1926) and its eastward extension were mechanically stripped, as well as a previously unknown zone of gold mineralization referred to as the Swamp Lake showing and its northeast extension referred to as the Rentz showing. These areas recorded anomalous to economic gold-assay values of up to 10000 ppb gold (0.3 ounce Au/ton).
>
> The Morgan showing, which is positioned on the southern fault scarp of the Blackwater River fault (Empire fault), is a partially sulphidized oxide Fe formation hosted in a sheared metavolcanic rock displaying a 5 m wide halo of strong hydrothermal alteration consisting of dolomite to ankerite alteration, silicification and limonite staining. Within the Morgan showing, gossan is a 0.8 m wide massive sulphide lense of arsenopyrite (60 percent) and pyrrhotite (40 percent) and a 1 m wide quartz-carbonate vein. Rock grab samples and channel samples of the Morgan showing provided the following anomalous gold-assay values: 1500 ppb, 1600 ppb, 1700 ppb, 4500 ppb (0.13 ounce Au/ton), 4600 ppb (0.14 ounce Au/ton) and 5900 ppb (0.17 ounce Au/ton). Located 700 m eastward along the Blackwater River fault within a sheared metavolcanic rock is a 20 cm wide by 100 m quartz-carbonate vein postulated to be the eastward extension of the Morgan showing. Rock grab samples and channel samples of this mechanically stripped area provided the following anomalies to economic gold-assay values: 450 ppb, 610 ppb, 720 ppb, 840 ppb, 2200 ppb (0.06 ounce Au/ton), 4600 ppb (0.15 ounce Au/ton) and >10000 ppb (0.30 ounce Au/ton).
>
> The Swamp Lake showing is associated with a N070°E structural lineament and consists of a massive, strongly carbonatized, mafic metavolcanic rock unit hosting parallel quartz-carbonate veins (10 cm to 25 cm wide). The host volcanic rock also displays upwards to 10 percent ubiquitous arsenopyrite mineralization. Rock grab samples and channel samples provided the following anomalous to economic gold assay values: 170 ppb, 290 ppb, 680 ppb, 990 ppb, 10000 ppb (0.30 ounce Au/ton) and >10000 ppb (0.30 ounce Au/ton). Located 600 m northeast of the Swamp Lake showing along the same structural lineament is the Rentz showing which consists of sheared, pillowed, mafic metavolcanic rock which has undergone strong hydrothermal alteration (carbonatization, silification and limonite staining). Narrow discontinuous quartz-carbonate veins occur throughout the exposure and often host disseminated sulphide mineralization. Pyrite is the dominant sulphide mineral and occurs as fine-grained cubic pyrite and as semi-massive lenses of sulphide mineralization within the metavolcanic rocks and along quartz-carbonate vein margins. Rock grab samples and channel samples provided the following anomalous gold assay values: 150 ppb, 1070 ppb (0.033 ounce Au/ton) and 1100 ppb (0.035 ounce Au/ton)."

Standingstone–Archie Lakes Occurrence

The Standingstone–Archie lakes occurrence is located immediately south of Archie Lake in the northeastern part of Summers Township. The property is accessible by travelling 5.3 km along Highway 580, from its junction with Highway 11 just north of Beardmore, to Camp 72 or Sturgeon River Road. The main showing is reached by travelling 4.2 km in a northeasterly direction along this road. In June of 1989, Placer Dome Inc. optioned a 37-claim block from a local prospecting syndicate (E. Rentz, O. Belisle and J. Ternowesky) and began an extensive exploration program over the Standingstone–Archie lakes property. Work included stripping, geological mapping, detailed lithogeochemistry, channel sampling and diamond drilling.

The earliest recorded activity in the area was by the Jake-Stur Prospecting Syndicate in 1947 over a 27-claim block covering a portion of the present-day property. An extensive trenching program was conducted over a mineralized quartz-stockwork vein system and a silicified shear zone. From 1954 to 1972, a six- to nine-claim block was worked by E. Jones and J. Sijpkens covering an area west and southwest of Archie Lake. Exploration during this period consisted of trenching, magnetometer and self-potential surveys, airphoto analysis, geological mapping, and diamond drilling totalling 340 m. The Jones-Sijpkens work resulted in the discovery of a pyrite-arsenopyrite-bearing silicified shear zone south of Archie Lake which is a major focus of Placer Dome Inc.'s present exploration program (D. Laudrum, Supervising Geologist, Placer Dome Inc.) (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). In 1987, an airborne magnetometer and very low frequency electromagnetic (VLF-EM) survey was completed by Terraquest Ltd. for Jet Mining Exploration Inc. over the current property.

Most of the Standingstone–Archie lakes property lies within mafic metavolcanics of the main Beardmore–Geraldton belt. D. Laudrum (Supervising Geologist, Placer Dome Inc.) (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay) describes the local geology:

> "The Geology of the property is dominated by ENE trending mafic metavolcanics. Volcanics range from massive and pillowed flows to tuff-agglomerates. An ENE trending fault, which runs along the length of Standingstone Lake, is a structural break which separates the volcanics from the metasediments which occur along the southern edge of the property. This structure is thought to be related to mineralization at the Leitch and Sand River properties which lie to the SW of the Archie Lake property. Foliation, shearing, and most quartz veining throughout the property are generally parallel to the ENE trend.
>
> Two main shear zones hosting mineralized quartz veins have been identified SW of Archie Lake. These zones have been identified along a strike length of 1200 m. The 'north zone' is characterized by a 0.1 to 1.0 m quartz vein containing up to 20% rusty patches of iron carbonate (ankerite) and minor pyrite. The vein is hosted in a 3 m wide zone of sheared and ankerite altered volcanics. In one exposure the vein contains up to 20% tourmaline as massive stringers and disseminated accicular crystals. The 'south zone' is characterized by a strong shear 0.75 to 2 m wide which hosts variable amounts of quartz veining. Quartz veining ranges from massive quartz-ankerite veins to brecciated quartz containing 30% inclusions of silicified chloritic basalt with up to 5% arsenopyrite. A sharply defined zone of rusty brown ankerite alteration in sulfidized (2% pyrite) volcanics extends up to 3.0 m outward from the shear zone.
>
> These ENE trending quartz-tourmaline-pyrite-arsenopyrite bearing shear zones display the most promising environment for gold mineralization identified to date on the property."

Diamond-drill core recovered by Placer Dome Inc. in 5 holes (totalling 884 m) completed during the 1989 season displays sections (0.95 to 1.42 m) of strongly silicified mafic to intermediate flow rocks containing up to 15 percent pyrite and 5 percent arsenopyrite. Carbonatization and strong epidote alteration was also noted. Geochemical results are pending. Surface grab samples collected by the authors and Jet Mining Exploration Inc. personnel (1988) on the property returned assays ranging from 0.04 to 0.13 ounce gold per ton (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

Jacobus Prospect

The Jacobus prospect is located in the northwestern corner of Elmhirst Township, approximately 31 km northeast of Beardmore, Ontario. The property is accessible from Highway 801 via an old bush road (Pinel Creek Road) at a point roughly 20 km north of Highway 11. On June 1, 1989, the 18-leased claims, comprising the original Jacobus property, were released for staking by the Crown (Province of Ontario) following forfeiture of these claims. This occurred after Jacobus Mining Corp. Ltd. and Chesterville Mines Ltd. (former owners of the property) had their corporate charters cancelled in 1976. Five separate parties were involved in the staking rush on June 1, and the majority of the old leased claims are presently held by N. Cox (prospector, Beardmore). Additional claims were also staked by N. Cox along the western extension of the original property.

Past exploration work on the Jacobus prospect included four parallel trenches (which strike 235°) developed by the original owners (Christianson Prospectors Syndicate) over the main showing in 1947, and in excess of 60 diamond-drill holes completed by The International Nickel Co. of Canada Ltd., Jacobus Mining Corporation Ltd. and Chesterville Mines Ltd. between 1948 and 1972. Numerous geological surveys, geophysical surveys and geochemical-sampling programs were also conducted during this period. Drill-indicated reserves to date are 1000000 tons at a combined grade of 0.94 percent Cu-Ni (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The property area lies along the northwestern contact zone between the Elmhirst Lake stock (consisting of medium- to coarse-grained granite to granodiorite) and felsic to intermediate metavolcanics (massive and porphyritic flows of dacitic to rhyodacitic composition) of the Onaman–Tashota metavolcanic belt. Intruding the contact zone and hosting the Jacobus prospect is a mafic, dioritic to gabbroic intrusion roughly 1 by 2 km in plan area (Mackasey and Wallace 1978). Faust's (1973) work indicated that the intrusion forms a 180 m (minimum) thick sill striking 070° and dipping from 45° to 60° north and suggests ". . .that the body is a differentiated layered mafic-ultramafic sill. Although gabbro and quartz gabbro are by far the most prominent rock types encountered, the occurrence of metaproxenite and anorthositic gabbro suggested that more ultramafic differentiates may occur within the intrusion".

Samples of bedrock exposures at the prospect are described as medium-grained diorite to gabbro with minor variations in texture and mafic-mineral content; this gives the rock a somewhat patchy appearance. The surface is highly weathered and displays much gossan staining.

Sulphide mineralization, in order of abundance, consists of pyrrhotite, chalcopyrite and pentlandite and is interstitially disseminated in amounts up to 10 percent. Pyrrhotite occurs in irregular blebs averaging 5 mm, commonly rimmed by chalcopyrite and pentlandite. Chalcopyrite also occurs as discrete, irregular grains from 2 to 3 mm in size.

Grab samples collected by G.D. White (1989) and chip samples taken by P. McCulloch (geologist, A.C.A. Howe International Consultants, Toronto) over the four surface trenches averaged from 0.45 to 0.53 percent Cu and from 0.26 to 0.39 percent Ni (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). Recently reanalyzed (October 1989) core samples, averaging 1.52 m (5 feet) in length from past drilling by Jacobus Mining Corp. Ltd. in 1957, ranged up to 2.42 percent Cu and 1.95 percent Ni. In addition, an induced polarization (IP) geophysical survey, completed on behalf of Chesterville Mines Ltd., in 1971, delineated two additional zones, outside of the main showing, that warrant further examination for economic base metal potential (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

South Onaman River Base Metal Prospects

The South Onaman River base metal prospects are located west of Onaman Lake and 45 km (28 miles) north-northeast of Beardmore, Ontario. The prospects are accessible via the Kinghorn–Con Creek road system and then east on a number of unmarked timber roads. N. Cox (prospector, Beardmore) holds 36 claims covering the prospects.

The Tashota-Nipigon Mine, the only past producer in the Onaman River area, produced 12355 ounces of gold grading 0.24 ounce gold per ton, 14527 ounces of silver grading 0.28 ounce silver per ton and 360306 pounds of copper. The earliest recorded exploration work on the South Onaman River base metal prospects was performed by New Bidlamaque Gold Mines Ltd. who conducted magnetic and electromagnetic surveys, and diamond drilling (1959, 1960). Shawmin Explorations Ltd. (1973), Geophysical Engineering Ltd. (1975), and Abitibi–Price Inc. (1980) have performed limited exploration programs in the southern part of the Onaman River area. The most recent work was completed by Cane Consolidated Explorations Ltd.–Americ Mines Ltd. (1982, 1983). Work included a VLF-magnetometer survey, geological survey and diamond-drill program after a new mineralized zone was discovered on the south part of the claim block.

The South Onaman River base metal prospects are underlain by mafic metavolcanics, a portion of the Onaman–Tashota belt. The metavolcanics consist of pillowed to massive mafic flows, tuff and iron formation which have been intruded by the West Onaman Lake batholith to the east—a biotite (hornblende) trondhjemite to granodiorite to quartz monzonite intrusion. The metavolcanics are overlain to the west by a clast-supported polymictic conglomerate. Regional foliation is southerly trending, and pillows suggest that younging is to the west and southwest (Amukun 1980; Thurston 1980).

Four main base metal showings make up the South Onaman River base metal prospects: 1) the D-9 conductor; 2) the Abitibi prospect; 3) the Cane prospect; and 4) the South Zinc occurrence.

The D-9 (electromagnetic) conductor, located on the loop road (local name) east of the Con Creek Road, has a strike length of 240 m (approximately 800 feet) at 020°. The surface expression of the electromagnetic conductor is made up of two sulphide zones in a 12 m (40 feet) wide shear zone. Massive seams of arsenopyrite, 2 to 4 cm thick, occur associated with discrete zones of chalcopyrite. Arsenopyrite-rich grab samples assay up to 0.42 ounce Au per ton, 2.87 percent Cu and 1100 ppm Zn (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). Up to 10 percent chalcopyrite is present in sheared and silicified mafic metavolcanics. A unique lithology observed is termed "puddingstone"; it may be a silicified lapilli tuff or the product of two cleavage intersections.

The Abitibi prospect, located west of the D-9 conductor, consists of banded and brecciated massive sulphides hosted in mafic metavolcanics. Chalcopyrite, pyrite, sphalerite and galena are hosted in silicified, brecciated and carbonatized pillowed basalts. The massive sulphide zone strikes 355° and is a minimum of 1.5 m (5 feet wide). A selected grab sample analyzed 880 ppm Cu, 1.44 percent Pb and 5.76 percent Zn (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The Cane prospect occurs 1.4 km (0.9 miles) south of the D-9 conductor and the Abitibi prospect. The showing is hosted by a brecciated carbonate horizon contained within silicified and carbonatized basalts. Galena, pyrite, minor sphalerite and minor chalcopyrite occur as semimassive sulphides in a breccia up to 2.4 m (8.0 feet) wide. A thin-banded chert unit overlies the Cane prospect. The zone strikes at 355° and dips west at 57°. A selected grab sample assayed 1860 ppm Cu, 9.8 percent Pb and 5.2 percent Zn (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The South Zinc occurrence is situated immediately south of the Cane prospect. The occurrence is comprised of banded cherty (minor magnetite) iron formation containing sphalerite and minor chalcopyrite. Sphalerite occurs as patches and seams and the chert is recrystallized. The mineralized zone averages 1.5 m (5 feet) in width and strikes 060°. A selected grab sample analyzed 282 ppm Cu, 3700 ppm Pb and 5000 ppm Zn (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

FORT HOPE AREA

General Geology and Structure

The Fort Hope area westward to Miminiska Lake is within the eastern part of the Uchi Subprovince—an east-trending, predominantely metavolcanic-metasedimentary belt.

The Miminiska Lake area is underlain by a metasedimentary sequence of wacke, sandstone, and oxide-, carbonate- and silicate-facies iron formation. The metasediments overlie a pillowed to massive, mafic metavolcanic sequence. A second mafic metavolcanic unit is located north of the metasediments. A thin unit of coarse-grained clastic metasediments (conglomerate, possibly sandstone, and arenite) occurs in the western part of the area. Quartz monzonite to granodiorite plutons intrude the metasedimentary-metavolcanic sequence. Diabase, feldspar porphyry, quartz-feldspar porphyry and pegmatite dikes cut the metavolcanics (Wallace 1981).

The Opikeigen Lake–Fort Hope area to the east of the Miminiska Lake area has been described by Wallace (1978):

> "Alternating units of felsic metavolcanics (including rhyolitic to dacitic, fine to coarse pyroclastic rocks and massive and autobrecciated flows) and metasediments (including wackes, argillite and derived schists, quartzite and conglomerate) with minor bands of mafic metavolcanics are overlain by a thick accumulation of predominately mafic metavolcanics (including basaltic to andesitic, massive and pillow lavas, amphibolite schist agglomerate, autoclastic breccia and Algoma-type iron formation)."

Another interpretation is that part of the southern half of the Opikeigen Lake–Fort Hope belt is comprised of a tectonically interleaved assemblage of volcanic and sedimentary strata with stratigraphic tops indicators facing dominantly northward. Interleaved sequences have been previously noted as forming the main Beardmore–Geraldton belt where a similar tectonic setting is present (Devaney and Williams 1989). Interleaved sequences like the Opikeigen Lake–Fort Hope belt and Beardmore–Geraldton belt occur close to the subprovince boundaries as a lensoid terrane.

The Beardmore–Geraldton interleaved sequence has been interpreted as a zone forming part of a fore-arc accretionary prism along the southern margin of a volcanic arc, the south flank of the Wabigoon Subprovince (Williams 1989). Such a prism records characteristic upright shallowly plunging folds formed by northerly to northwesterly directed regional shortening during the Kenoran Orogeny. The presence of fault zones in contact with lithologies in the Opikeigen Lake–Fort Hope belt and northward-facing stratigraphic top directions suggests similarities with the environment of the main Beardmore–Geraldton belt. Extensive overburden in the eastern Uchi Subprovince prevents continuous observations through large portions of the Opikeigen Lake–Fort Hope belt.

Gold Deposits

In a regional sense, gold occurrences may have formed in a tectonic environment similar to the Beardmore–Geraldton belt, although specific metal associations can vary on an occurrence or deposit scale.

There are seven gold-deposit types in the Fort Hope area: 1) gold-antimony veins within shear zones (Howells Lake); 2) gold-associated, arsenopyrite-rich iron formations (Goss Lake prospect); 3) gold-tungsten veins and related shear zones hosting auriferous pyrite-pyrrhotite mineralization, possibly representing a portion of larger fault zones (Reserve Creek occurrences); 4) gold mineralization within strongly foliated to sheared and mylonitized, mafic to felsic metavolcanics (Eabamet Lake area); 5) gold mineralization within silicified-carbonatized clastic metasedimentary rocks (Miminiska Lake area); 6) quartz-tourmaline-gold veins (Miminiska Lake area); and 7) feldspar ± quartz porphyry intrusions hosting shear- and vein-associated gold mineralization (Keezhik Lake–Fort Hope–Miminiska Lake area).

Base Metal Deposits

Base metal occurrences including copper, nickel, and/or zinc have been located: 1) southeast of Fort Hope, in the Makokibatan Lake–Schist Lake area; 2) northeast of Fort Hope, in the Norton Lake area; 3) the Lansdowne House-Lavoie Lake–Rowlandson Lake area; 3) south of Fort Hope, in the Sim Lake area; 4) southwest of Fort Hope, in the Kawitos–Auger Lake area; and 5) in the Summer Beaver area.

Geochronology

Geochronology samples were taken for U/Pb zircon dating from the Fort Hope area (work to be carried out by F. Corfu at the Royal Ontario Museum, Toronto) from the following locations:

1. A coarse-grained, thickly bedded, quartzose sandstone from the Miminiska Lake area, south of the old Gold Fields Mining Corporation's camp, and at a Proterozoic diabase dike's paleomagnetism sampling site (separate study). The sample should date the zircon sources and possibly give a maximum age for sedimentation.
2. A Gold Fields Mining Corporation camp's drill-core sample of a trondhjemite dike within wacke; this will obtain a minimum age for sedimentation.
3. The Keezhik Lake feldspar-porphyry stock to date the felsic metavolcanic pile occurring in the northern portion of the east Uchi Subprovince.
4. The Opikeigen Lake (Rond Lake) feldspar-porphyry tuff to date a felsic unit situated in the eastern part of the belt.
5. The Fort Hope Mine feldspar porphyry to compare its date with that of the Opikeigen Lake (Rond Lake) tuff. If they're the same age, then it is likely that the younging direction is to the north and not to the south as is presently mapped by Wallace (1978).

Boylen Occurrences

The Boylen occurrences are located 26 km (16 miles) southwest of Fort Hope, Ontario. The most eastern occurrence of the Boylen group is 1.6 km (1 mile) south of Kawitos Lake (Albany River). Access is by float plane to Kawitos Lake or by helicopter. Sixteen claims were staked during 1989 to cover three occurrences: Boylen prospect (Cu, Ag), Doorigan property–Alpamayo occurrence (Cu, Ag, Ni) and the Ryley–Cormac occurrence (Zn, Pb, Ag, Cu). Cumulatively, the property is termed the Boylen occurrences and is held by S. Parent (geologist, Thunder Bay). Line cutting, magnetometer surveys, VLF-EM surveys, prospecting and preliminary sampling were undertaken.

The Boylen occurrences are located in the eastern part of the Uchi Subprovince, within the Attwood Lake metavolcanic-metasedimentary belt. The Boylen properties occur in the northern part of the Attwood Lake belt, a northerly and northeasterly trending belt. Metasediments consist of arkose, greywacke, quartzite and conglomerate. Massive to foliated basalt and andesite, and layered amphibolite make up the metavolcanic assemblage. Regional foliation in the north part of the Attwood Lake metavolcanic-metasedimentary belt trends approximately 045° (Thurston et al. 1969). Felsic metavolcanics outcrop to the southwest along the same trend in the Auger Lake–Vertente Bay area and have been documented by New Jersey Zinc Exploration Co. (Canada) Ltd. in the Boylen occurrences area. Anorthositic gabbro and granodiorite intrude the mafic metavolcanics.

The Boylen prospect is hosted in a medium- to coarse-grained amphibolite intruded by granodiorite and granite gneiss. Foliation in the supracrustal rocks trends 025°. Three cross trenches had previously been blasted by the discoverer, M.J. Boylen Engineering (in 1961), as part of a multiphase exploration program which included a magnetometer survey, electromagnetic survey and diamond-drilling program. Mineralization exposed in the trenches includes chalcopyrite, pyrite, sphalerite, pyrrhotite, galena and magnetite. Drilling by M.J. Boylen Engineering intersected a wide carbonate alteration zone. Assay values from samples taken over sections of up to 3.6 m width (12 feet) have recorded grades of 0.82 percent Cu in drill core and up to 6850 ppm Cu in grab samples (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The Alpamayo occurrence on the Doorigan property is located southwest of, but contiguous to, the Boylen prospect and was discovered in 1989. The Alpamayo occurrence is underlain by garnetiferous-chlorite-biotite schist—a possible hydrothermally altered rock unit. Granite gneiss, amphibolite and foliated mafic metavolcanics occur regionally on the Doorigan property, but the amount of exposure is limited due to ground moraine cover (S. Parent, Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). A VLF-EM survey, following line cutting and a magnetometer survey, defined a conductor within 30 m of the Alpamayo occurrence. Grab samples assayed up to 5.85 percent Cu.

The Ryley–Cormac occurrence is located 3.2 km (1.9 miles) west-southwest of the Alpamayo occurrence. Line cutting, geological mapping, geophysics and diamond drilling were carried out by M.J. Boylen Engineering. Drill hole 343-3 intersected mineralized sections which yielded the following assay results:

216-227 feet	4.27 percent Zn, 0.28 percent Pb, and 0.28 ounce Ag per ton
242-252 feet	2.14 percent Zn, 0.19 percent Pb, and 0.15 ounce Ag per ton

(Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

New Jersey Zinc Exploration Co. (Canada) Ltd. drilled two "Winkie" holes during 1976 and intersected 0.3 m (1.1 feet) of rock assaying 4.0 percent Zn with an association of minor chalcopyrite. Lithologies intersected include rhyodacitic agglomerate, garnet-chlorite schist and mafic to intermediate flow rocks (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

S. Parent's ground electromagnetic survey (conducted in 1989) noted a weak conductive zone on the known occurrence. Other VLF-EM conductors occur north and south of the zinc occurrence and can be coincident with a strong magnetic trend. Three grab samples taken during 1989 from the Ryley–Cormac occurrence assayed the following:

Sample	Width (m)	Zinc (%)	Lead (%)	Silver (oz./t)
1	0.1	11.92	1.13	1.1
2	0.2	12.32	1.05	2.4
3	0.1	26.04	0.80	0.99

(S. Parent, Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay)

RESEARCH BY RESIDENT GEOLOGIST'S OFFICE STAFF

HISTORICAL RESEARCH PROJECT

The Historical Research Project is funded by the five year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. The objectives of the Historical Research project are to 1) document old and forgotten gold occurrences and prospects, mainly in the Beardmore–Geraldton area; 2) attempt to locate these old occurrences and prospects in the field, and, if found, try to evaluate their mineral potential; and 3) provide the information gathered to prospective clients in readily researchable file format.

The project involves the in-depth search of old literature (The Northern Miner, mining journals, newspapers, magazines, government reports, etc.) for information on mineral occurrences in the Beardmore–Geraldton District, Thunder Bay Mining Division. Each article is copied, referenced, map located (if possible), and filed by: 1) property name, ordered alphabetically according to its National Topographic System (NTS) location, and 2) chronologically by its publication date.

Table 6.2 lists sources that have been searched in the Thunder Bay office prior to and including the current project time frame. K.G. Fenwick (Manager, Mineral Resources, Northwestern Region) commenced historical research in the Thunder Bay Mining Division in 1981.

Also researched during 1989 were the files of the Kenora Lake of the Woods Museum, the Nipigon District Museum, the Fort Frances Museum, and files from the Resident Geologist's offices in Sioux Lookout, Red Lake and Kenora to obtain information and old photographs of previous mining activity in their particular areas.

Benefits of Project

Mineral occurrence files are created to aid exploration companies and prospectors in assessment of mineral properties within the Beardmore–Geraldton District. Mineral occurrences that have been lost in the literature are identified for follow-up field visits, and for their exploration potential.

As a secondary benefit, the Mining Recorder's Office has had their Historical Staking–Assessment records updated from records maintained in Toronto.

Present Status

An open file report, including text and appended mineral occurrence write-ups, is being written in conjunction with field examinations of selected properties. Historical mineral deposit files are being expanded as "new" old data is collected and processed within the NTS and chronological files.

In 1989, *The Northern Miner* was researched from the years 1945 to 1948 inclusive. The *Canadian Mines*

TABLE 6.2. HISTORICAL RESEARCH PROJECT: ARTICLES RESEARCHED.

	Source Articles	Dates of Articles
1.	a) Canadian Mining Review	1883–1907
	b) Canadian Mining Journal	1908–1930 1936–1960
2.	The Precambrian	1932–1958
3.	The Daily Sentinel and North Shore Miner	1882, 1884–1890
4.	Thunder Bay Sentinel	1879–1893
5.	The Weekly Herald and Lake Superior Mining Journal	1882–1887
6.	The Weekly Herald and Algoma Miner	1889–1895
7.	The Daily Journal	1895–1899
8.	The Fort William Daily Times Journal	1900–1936
9.	The Weekly Times Journal	1903–1905
10.	The Morning Herald	1909, 1912
11.	The Northern Miner	1915–1948
12.	The Engineering and Mining Journal	1881–1902
13.	Gold Magazine of Canada's North	1933–1939

Handbook has been researched from 1945 through to 1955 inclusive. The *Fort William Daily Times Journal* has been researched from 1928 through to and including 1932.

The project thus far has had a number of successes resulting in the rediscovery of old mining locations. However, difficulties arise due to 1) the vague descriptions of the nature and locations of some of the properties in the articles and reports, and 2) the time frame involved (i.e., some of the mineral occurrences record exploration that is fifty, or more, years old and therefore old workings are difficult to identify in the field—they may be completely overgrown with vegetation or filled with debris, etc.).

The following three property descriptions depict the nature of the research involved in this program.

The McFarlane-Manion Occurrence

The McFarlane–Manion occurrence is located 6.4 km (4 miles) east of Redmond, a railway point on the Canadian National Railway, in the south-central part of Gzowski Township.

The McFarlane–Manion occurrence was first reported by Hopkins (1916) in his report of the Kowkash Gold area. The property was researched through this program and described in *Report of Activities 1987, Resident Geologists* (Mason et al. 1988).

The property was subsequently staked by two prospectors, G. Milks and C. Paul, both from Hornepayne, Ontario, who rediscovered the old workings as well as other mineralized quartz veins in the area.

The prospectors have discovered approximately 12 old pits and/or trenches on the property, including the old McFarlane–Manion shaft, sunk between 1915 and 1916, located just north of Wilgar Creek. The initial vein system has been stripped for approximately 15 m (49 feet) along strike, west of the old shaft, and consists of a massive white quartz vein and a quartz vein breccia zone containing various-sized fragments of argillite. The vein consists of two main components: 1) to the north, a 60 to 75 cm wide unit of massive, coarsely granular, bull-white quartz in contact 2) to the south with a quartz vein breccia zone that is from 90 cm to 1.2 m wide. The quartz-vein breccia contains altered, black, argillitic fragments up to 50 cm in diameter (but averaging 5 cm) with 3 percent irregular blebs of chalcopyrite and fine-disseminated pyrite. Chlorite-sericite bands were also noted within the quartz in association with the fragments. At the bottom of the 4.5 m deep shaft (1.5 by 1.5 m^2) sunk down on the vein system by the original owners, a flat-lying seam of from 2 to 5 mm in width of massive sphalerite and galena was noted. These two minerals were not observed in any of the other exposures on the property. Mineralization outside the vein exposure in the shaft area is generally sparse; that is, 1 percent to less than 1 percent pyrite. Only minor weathered sulphide iron staining was noted.

The composite nature of the vein system indicates two ages of quartz material being generated along the same fracture or shear zone. The massive white quartz vein appears to be younger in age with perpendicularly disposed veinlets of this material crosscutting the quartz vein breccia unit.

The surrounding host rock is a fine-grained, dark grey to black argillite, often showing a banded nature, in association with the shear zone of the main quartz vein system. A medium-grained feldspar-porphyry dike was also noted adjacent to the main vein in one of the trenches.

Selected best assay values from the McFarlane–Manion property (more assay values are available in the Resident Geologist's Office, Ministry of Northern Development and Mines, Thunder Bay) are listed in Table 6.3.

Assays for the McFarlane–Manion property range in values of gold from nil up to 0.29 ounce Au per ton (Hopkins 1916) and up to 3.71 ounces Ag per ton (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

Other base metal assays range in values from 0.13 to 2.07 percent Cu, 0.10 to 19.4 percent Pb, and 0.20 to 9.5 percent Zn (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

The Larson Occurrence

The Larson occurrence is located approximately 14.5 km (9 miles) north of Jellicoe in Rickaby Township, northwest of Atigogama Lake and southwest of Dilla (Dillabough) Lake.

The area is underlain by massive, pink to grey, granitic-to-trondhjemetic rocks of the Kaby Lake stock.

TABLE 6.3. ASSAY VALUES FROM THE McFARLANE–MANION PROPERTY.

Sample Number	Location/ Claim Number	Gold (oz/ton)	Silver (oz/ton)	Copper (ppm)	Lead (%)	Zinc (%)
89–MMM–1	TB1036054 Pit #6 (shaft)	0.0238	1.487	435	8.0	2.43
89–SMM–1	Pit #6 (shaft)	0.08	2.10	1430	19.4	9.5
89–SMM–2	footwall Pit #6 (shaft)	0.03	0.87			

The granitic rocks are cut by several small mafic dikes, chlorite schists and minor quartz diorite.

The Larson occurrence was first described by Burwash (1933) in his report on the *Atigogama and Dillabough Lakes Area*. Burwash described the property as follows:

> "These claims staked by Larson to the west of Atigogama lake have a well sheared and superficially weathered zone in the granite which carries finely divided molybdenite and molybdenum ochre. The molybdenite is in cracks in the quartz which fills the interstices between granite fragments in a crushed zone. The best part of this vein is said to carry values of $4.60 in gold over a width of 15 inches". (Note: in 1933, gold was valued at $28.94 per ounce.)

Mineralization consists of minor disseminated pyrite within the granitic rocks. Only minor quartz veining was observed in the numerous trenches which were found during two visits made in 1989.

One trench occurs north of the main workings and grab samples from it were assayed with the following results:

Sample Number	Gold (oz./ton)	Silver (oz./ton)
89-SLN-1	0.035	nil
89-SLN-2	0.022	trace

Two grab samples from rusty stained float, occurring adjacent to a trench within the main workings, yielded the following assay results:

Sample Number	Gold (oz./ton)	Silver (oz./ton)
89-SLN-1	0.086	0.16
89-SLN-2	0.123	0.29

The Chipman Lake (Powell) Occurrence

The Chipman Lake occurrence is located on the eastern shore of the south narrows of Chipman Lake and is presently unstaked. Only one old pit/trench was found during a property visit, although a thorough search was made in the vicinity of indicated past workings. (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay.)

The property is underlain by an east-trending belt of mafic to intermediate metavolcanics, generally composed of banded amphibolite and tuffs and lapilli tuffs. This belt is intruded by an east-trending quartz monzonite and granodiorite intrusion. Both the felsic intrusive rocks and metavolcanics are cut by north-trending diabase dikes. The Chipman Lake fault trends northerly through Chipman Lake. Displacement of lithologic units along the fault is unknown (Sage 1983).

The southern part of the property contains units of partly to well banded paragneisses. North of the paragneisses are well-banded tuffs of intermediate composition. Mafic metavolcanics lie north of the tuffs as well as minor remnant pillow lava. To the north and east of the property, an intermediate to felsic intrusion of diorite to syenodiorite, known as the Chipman Lake stock, occurs. The diorites and syenodiorites are usually massive, medium grained, equigranular, and locally foliated and porphyritic. A younger body of granite lies between the metavolcanics and surrounding granitic rocks. (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay.)

The following description of the mineralogy is taken from a report by E.G. Pye (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). The date of the visit is unknown.

> "Two mineralized zones have been located. One lies in diorite along the contact with volcanics to the south. It strikes E-W and consists of massive to disseminated sulphides (pyrite, pyrrhotite and minor chalcopyrite) over widths up to, and possibly exceeding, 25 feet. The massive sulphides occur north of and parallel the diorite-greenstone contact, from which they are separated by a zone up to 20 feet wide, of disseminated mineralization.
>
> The second zone lies about 160 feet south of and parallels the first. It is of similar character, but lies in volcanics south of a second sill-like body of diorite. This zone has been exposed over a width of 20 feet at one point, and has been traced for a length of 300 feet. The dip of the schistosity in one outcrop along this zone was recorded at 37 degrees north."

A report by Hopkins (1918) on the south zone stated the following:

> "A chipped sample across 3.5 m (10 feet) yielded on assay the following:
>
> Nickel 0.14%, gold 40 cents per ton (.02 oz/ton, 1918 Gold $20.67 per ounce), Copper and Platinum – none.
>
> Sample from the northern zone assayed the following: Copper 0.40%, Nickel 0.26%, Gold and Platinum – none."

The assay values listed in Table 6.4 were obtained from the only trench found at the time of the property visit.

DRILL CORE STORAGE PROGRAM

Officially opened in 1986, the Thunder Bay Drill Core Library is one of seven such libraries across the province operating as part of the Ontario Drill Core Storage Program. Each drill core library collects, stores, catalogues and preserves drill core and associated data, mainly from Ontario's mineral exploration and mining indus-

TABLE 6.4. ASSAY VALUES FROM THE CHIPMAN LAKE (POWELL) OCCURRENCE.

Sample No.	Gold (oz./ton)	Silver (oz./ton)	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Nickel (ppm)
89-SCL-01	0.004	nil	341	< 10	108	16
89-SCL-02	nil	nil	1440	10	105	440
89-SCL-03	0.014	nil	1430	< 10	103	396
89-SCL-04	0.003	nil	950	< 110	294	70

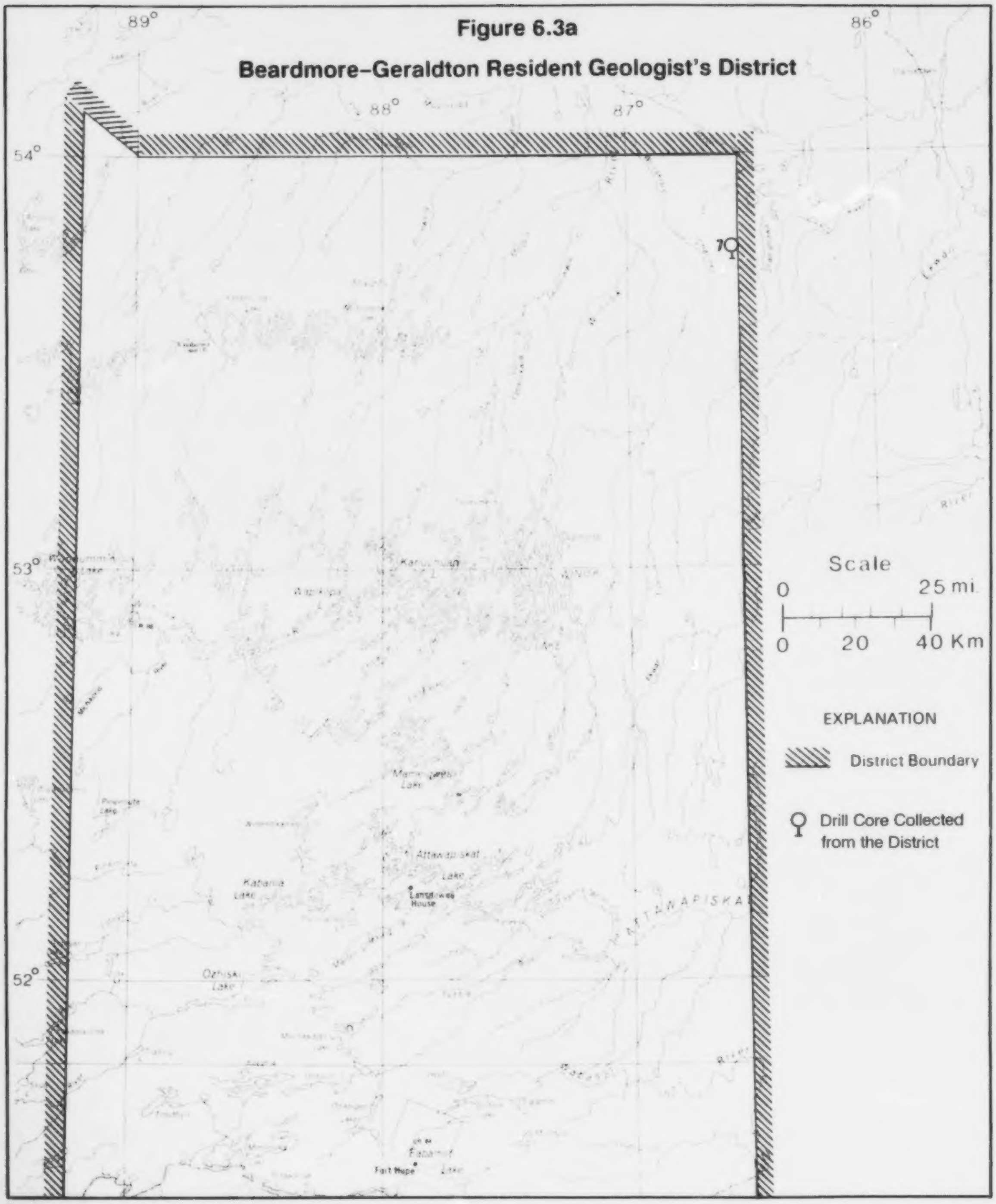


Figure 6.3a

Beardmore-Geraldton Resident Geologist's District

89°
86°
88°
87°
54°
53°
52°
7
Kanuchuan
Attawapiskat
Lake
Lansdowne
House
Kabania
Lake
Ozhiski
Lake
ATTAWAPISKAT
Eabamet
Fort Hope
Lake
River
Scale
0
25 mi.
0
20
40 Km
EXPLANATION
District Boundary
Drill Core Collected from the District

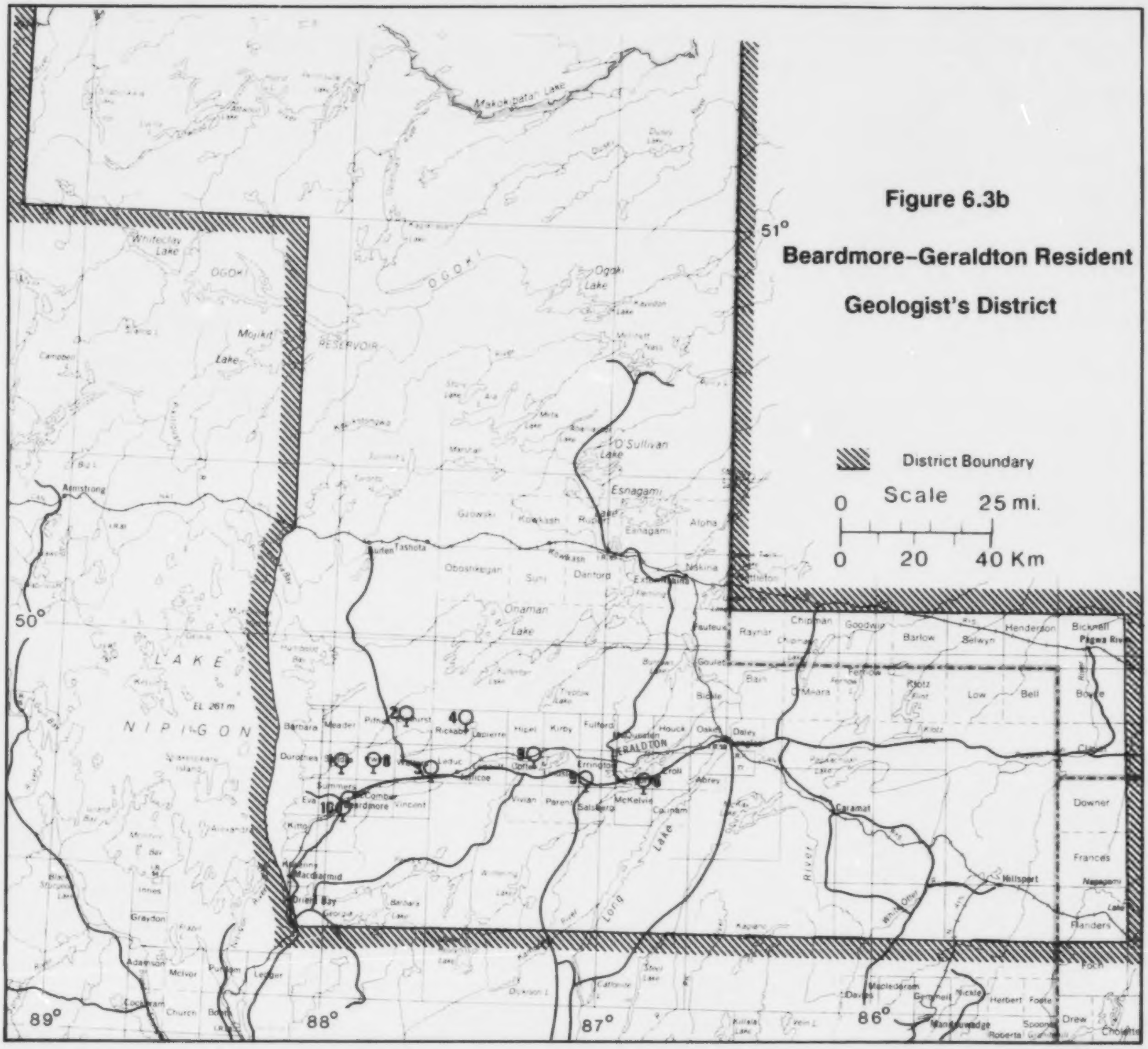


Figure 6.3b

Beardmore–Geraldton Resident Geologist's District

▨ District Boundary
Scale
0 25 mi.
0 20 40 Km
51°
50°
89°
88°
87°
86°
Makokibatan Lake
OGOKI RESERVOIR
Ogoki Lake
Whiteclay Lake
Mojikit Lake
O'Sullivan Lake
Esnagami
Armstrong
Onaman Lake
LAKE NIPIGON
EL 261 m
GERALDTON
Beardmore
Long Lake
Nakina
Caramat
Hillsport
Orient Bay
Macdiarmid
1
2
3
4
5
6
8
9
10

try. All drill core is eventually made available to the public for examination.

The Thunder Bay Drill Core Library collects drill core from the Thunder Bay Mining Division, which encompasses three Resident Geologist Districts: Thunder Bay, Beardmore-Geraldton and Schreiber-Hemlo.

If you would like to examine or donate drill core from the Thunder Bay Mining Division or if you have any questions about the Thunder Bay Drill Core Storage Program, please phone (807) 475-1331 or fax (807) 475-5312 or write to:

Thunder Bay Drill Core Library
Ministry of Northern Development and Mines
435 James Street South,
Thunder Bay, Ontario
P7C 5G6

As of November 30, 1989, 98825 m of drill core is stored at the Thunder Bay Drill Core Library. Of this, 21390 m from 42 properties in the Beardmore-Geraldton Resident Geologist's District is available for public examination.

In 1989, 4281 m of drill core from 15 properties in the Beardmore-Geraldton Resident Geologist's District were collected, stored and catalogued at the Thunder Bay Drill Core Library. Of these 15 properties, 12 are principally gold properties and 2 are principally base metal properties. Table 6.5 lists locations, number of drill holes and drill-core footages for some of these properties. The others are currently under a period of confidentiality.

Below are brief descriptions of two properties from which drill core was collected in 1989.

Noranda Exploration Company, Limited—Errington and Lindsley Townships: The Bankfield Mine

The Bankfield Mine property, in Errington and Lindsley townships (NTS 42E/11NE; UTM Zone 16, 494231E, 5504615N) is located near the town of Geraldton, 8.25 km west of Highway 584 and 250 m north of Trans-Canada Highway 11.

The Bankfield Mine ceased production in 1947. Approximately 229009 tons of ore yielded 66416 ounces Au and 7590 ounces Ag (Mason and White 1986). The property is presently held under option by Noranda Exploration Company, Limited.

The property is underlain primarily by clastic metasediments intruded by diorite, albite porphyry and diabase. The metasediments consist essentially of alternating beds of medium-grained, massive greywacke and fine-grained, slaty greywacke in the south overlain by conglomerate, greywacke, black slate and iron formation to the north (Pye 1951). Bedding generally strikes 110° to 120° and dips 75° to 80°S. Locally the beds strike more easterly with somewhat flatter dips (Mason and White 1986).

Observed stratigraphic relationships suggest the metasediments were first intruded by diorite, followed by albite porphyry, and then by diabase, which occurs as a prominent west-northwest-trending dike (Anglin 1987).

The Bankfield-Tombill lithotectonic zone, a major transcurrent fault, has been traced for several miles across the district and is up to 65 m wide on the property (Matheson 1948; Mason et al. 1989). This fault zone strikes approximately 110° and dips 70°SW (Pye 1951).

The main ore zone on the property is located just south of the Bankfield-Tombill fault zone. Gold occurs primarily in association with "opalescent" grey quartz veins in variably silicified, sulphidized, sheared and brecciated greywacke, and to a lesser extent, in altered porphyry and black slate (Pye 1951). Visible gold is locally relatively common, and grades of up to 0.56 ounce Au per ton have been reported (Pye 1951; Mason and White 1986). The major sulphides present are pyrite, arsenopyrite and pyrrhotite. Minor chalcopyrite, sphalerite, galena and native copper also occur (Pye 1951).

Major transcurrent faults in the Beardmore-Geraldton area, such as the Bankfield-Tombill lithotectonic zone, have the potential for hosting as yet undiscovered gold mineralization and warrant future exploration (Mason et al. 1989). In order to help facilitate such exploration, the Thunder Bay Drill Core Library has preserved 939 m of drill core donated by Noranda Exploration Company, Limited, from their 1988 drilling of the Bankfield Mine property.

The drill core consists of three complete holes varying in depth from 157 to 572 m. Most of the major lithologies and alteration types are represented and have been assayed for gold. Assays of up to 0.085 ounce Au per ton (silicified greywacke) are reported (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). One of the holes provides a complete section of the Bankfield-Tombill fault zone.

Gunnar Gold Inc., Sandra Township

In 1988, Gunnar Gold Inc. completed a seven-hole drill program at its property in central Sandra Township. The property straddles Long Rapids on the Namewaminikan River, approximately 13 km north of Beardmore. All drill holes on the property have bearings in the range of 180° to 190° and dips of 50°.

Drill core from four of the seven holes is presently stored at the Thunder Bay Drill Core Library.

Gunnar Gold Inc. drilled the seven holes through a Proterozoic diabase sill into underlying Archean metavolcanics and metasediments of the Beardmore-Geraldton belt (*see* Mackasey 1975 and Mason and White 1986, for descriptions of general geology in Sandra Township and the Beardmore area). In addition to the Proterozoic diabase, the drill holes intersect weakly metamorphosed mafic flow and tuffaceous rocks, intermediate flow and tuffaceous rocks, epiclastic sedimentary rocks and subordinate mafic and felsic dikes. Alteration products include silica, graphite, carbonate, hematite and epidote. Some sections of the drill holes contain abundant quartz and quartz-carbonate veins. Pyrite and

TABLE 6.5. DRILL CORE STORED AT THE THUNDER BAY DRILL CORE LIBRARY, 1989.
Unless otherwise noted, Table 6.5 lists properties in the Beardmore–Geraldton Resident Geologist's District from which drill core was collected during the period from December 1, 1988 to November 30, 1989. See Figures 6.1a and 6.1b for property locations.

	Company/ Individual	Property/ Location	Year Drilled	Number of Holes	Metres of Core Stored
1)	Gunnar Gold Inc.	Beardmore Sandra Township	1988	4	745
2)	Jacobus Mining Corporation Ltd. and Chesterville Mines Ltd.	Pinel Creek Elmhirst Township	1957, 1968, 1971, 1972	22	513
3)	INCO Gold Company	Solomon's Pillars Leduc and Walters Townships	1986	3	490
4)	Canadian Gold Resources Inc.	Dik–Dik Rickaby Township	1987	4	386
5)	Noranda Exploration Co. Ltd.	Bankfield Errington Township	1988	3	939
6)	Wilson, A.	Wilson–Hollinger Ashmore Township	1989	1	125
7)	Kennco Explorations (Canada) Limited	Winisk Winisk River	1971	2	3
+8)	Metalore Resources Limited	Brookbank Irwin Township	1986–1989	23	27.5
+9)	Mingold Resources Inc./Mid North Engineering Services	Paint Lake Colter Township	1989	8	9.5
10)	Ateba Mines Inc.	Pan Empire Mine Summers Township	1986	2	284.5

+Core specimens submitted for assessment credit, as per Section 76(6) of the Ontario Mining Act.

**Requested "confidentiality period" expired in 1989.*

pyrrhotite are generally associated with these veins (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

Drill holes also intersect zones of brecciation cemented by quartz and calcite which are up to 4.5 m wide. These structural zones may represent the westward extension of the Paint Lake fault zone, a major regional fault that separates the Beardmore–Geraldton belt from the Onaman–Tashota metavolcanic belt (Mason and White 1986).

Assay results of core samples range from nil to 0.04 ounce Au per ton. Anomalous gold values appear to be associated with zones of carbonate-hematite alteration (E. van Hees, Consultant Geologist, personal communication, 1989).

RECOMMENDATIONS FOR EXPLORATION

Follow-up work after the Tashota–Geraldton–Longlac area airborne electromagnetic survey (Maps 81259 to 81348, Ontario Geological Survey 1989) is recommended for base metals. Isolated conductor(s) in the Onaman–Tashota belt hosted in metavolcanic terranes (particularly felsic to intermediate) should be prospected. Formational conductors (iron formation) can be discerned from the more high-potential, isolated or "clustered", high-priority conductors. Copper, zinc, nickel and lead would be the main targets sought after. Phase one of the Geological Survey of Canada's lake sediment and water geochemical data, for multielements in the Beardmore–Geraldton Resident Geologist's District, is being released in 1989–90. These regional surveys have previously been conducted in the area adjacent to the north shore of Lake Superior producing good exploration data. Indicator metals for gold and base metals should be researched and field checked when the data is made available in early 1990. Phase two of field work was initiated in July 1989.

Two large data bases underused in the district are the Drill Core Library and Historical Research files. The potential of both libraries is unlimited.

The Toronto Lake to Caribou Lake area should be explored for base metals and gold in light of current research (Berger 1989), metal prices (precious and base metals), and a past absence of work in this metavolcanic-metasedimentary belt.

Within the Beardmore-Geraldton belt, major transcurrent faults, including the Bankfield-Tombill lithotectonic zone (Bankfield-Tombill fault) and the Paint Lake fault and associated splay faults, should be examined. These deformation zones (that may appear as lineaments on geological maps) have the potential for hosting gold mineralization, and should be explored by prospecting, magnetometer surveys, VLF-EM surveys, satellite imagery and aerial photographs. Alteration zones of carbonate, silica, potassium, and/or hematite associated with sulphide minerals (mainly pyrite) can occur with gold in such structures. Discovery of the Missing Link occurrence and Expansion Lake occurrence (Mason et al. 1989) lend support to this model. Fault-generated feldspar-porphyry and gabbro intrusive rocks should be explored. Gold can be associated with disseminated pyrite and arsenopyrite and/or stockwork-vein systems within the intrusions. Examples of these fault-generated intrusions include the MacLeod-Cockshutt albite porphyry and the Talmora gold mine gabbro, both situated near Geraldton.

ONTARIO GEOLOGICAL SURVEY AND COMDA-FUNDED ACTIVITIES

Two research programs were funded by the five-year Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. These are as follows:

1. A. Speed and S. Gaudino continued with the Historical Research Program in the Beardmore-Geraldton area.
2. D.U. Kresz (Precambrian Geology Section, Ontario Geological Survey) mapped Lapierre, Hipel and Lindsley townships and the Altitude Lake area north of Lapierre Township.

The Ontario Geological Survey conducted three programs in the district:

1. B.R. Berger (Precambrian Geology Section, Ontario Geological Survey) mapped the Toronto Lake area.
2. P. Money (Precambrian Geology Section, Ontario Geological Survey) initiated the preparation of 1:250000 scale compilation maps of the geology and mineral occurrences of the Long Lake-White River area.
3. G. Stott (Precambrian Geology Section, Ontario Geological Survey) initiated preliminary geochronology sampling in the east part of the Uchi Subprovince (Fort Hope area).

RESEARCH BY OTHER AGENCIES

E.H.W. Hornbrook (Resource Geophysics and Geochemistry Division, Geological Survey of Canada, Ottawa) commenced a lake sediment and water geochemistry sampling program in the Geraldton area.

Lakehead University, Thunder Bay, continued with three MSc thesis geology projects in the Beardmore-Geraldton area: 1) "Sedimentological processes operative in glacial deltaic settings" by S. Gaudino; 2) "Structural study of the Beardmore area: a traverse from the Paint Lake fault to the Quetico Subprovince" by P. Holmes; and 3) "Brookbank-Golden Highway gold deposit, Beardmore, Ontario" by B. Kowalski.

ACKNOWLEDGMENTS

G. White undertook a major role in writing the report. A. Speed and S. Gaudino wrote the Historical Research Project (COMDA-funded) section. P. Sarvas wrote the Drill Core Storage Program section. G. Stott contributed to the Fort Hope area geology section. C. Komar (secretary) typed the report. K.G. Fenwick (Manager, Mineral Resources, Northwestern Region, Ministry of Northern Development and Mines, Thunder Bay) reviewed the manuscript. Exploration personnel working in the Beardmore-Geraldton District provided invaluable data.

SELECTED PUBLICATIONS RECEIVED

Amukun, S.E. 1989. Precambrian geology, Little Marshall Lake area, District of Thunder Bay; Ontario Geological Survey, Report 267, 70p.

Amukun, S.E. and Thurston, P.C. 1982. Metasomatism, metamorphism and mineral potential of the Marshall Lake base metal deposit, northwestern Ontario, Canada; a paper presented at the GAC-MAC Joint Annual Meeting, Winnipeg, 8p.

Barrett, T.J. and Fralick, P.W. 1989. Turbidites and iron formations, Beardmore-Geraldton, Ontario: application of a combined ramp/fan model to Archean clastic and chemical sedimentation; Sedimentology, v.36, p.221-234.

Beakhouse, G.P. 1989. Geology of the Grenville Lake area, District of Thunder Bay; Ontario Geological Survey, Report 246, 75p.

Berger, B. 1989. Geology of the Toronto Lake area, District of Thunder Bay; Ontario Geological Survey, Open File Map 127, scale 1:15 840. (Available for viewing only at the Mines Library, Ontario Geological Survey and the Resident Geologist's Office, Thunder Bay.)

Colvine, A.C., Cherry, M.E., Dressler, B.O., White, O.L., Barlow, R.B. and Riddle, C. eds. 1989. Summary of Field Work and Other Activities 1989; Ontario Geological Survey, Miscellaneous Paper 146, 275p.

Devaney, J.R. and Williams, H.R. 1989. Evolution of an Archean subprovince boundary: a sedimentological and structural study of part of the Wabigoon-Quetico boundary in northern Ontario; Canadian Journal of Earth Sciences, v.26, p.1013-1026.

Fenwick, K.G., Giblin, P.E. and Pitts, A.E. eds. 1989. Report of Activities 1988, Resident Geologists; Ontario Geological Survey, Miscellaneous Paper 142, 391p.

Garland, G.D. ed. 1989. Proceedings of exploration '87: third decennial international conference on geophysical and geochemical exploration for minerals and ground water; Ontario Geological Survey, Special Volume 3, 914p.

Hood, P.J. and Tesky, D.J. 1989. Aeromagnetic gradiometer program of the Geological Survey of Canada; Geophysics, v.54, no.8, p.1012-1022.

Kresz, D.U. 1989a. Geology of the Lapierre Lake area, District of Thunder Bay; Ontario Geological Survey, Open File Map 130, scale 1:15 840. (Available for viewing only at the Mines Library, Ontario Geological Survey and the Resident Geologist's Office, Thunder Bay.)

——1989b. Geology of Lindsley Township, District of Thunder Bay; Ontario Geological Survey, Open File Map 131, scale 1:15 840. (Available for viewing only at the Mines Library, Ontario Geological Survey and the Resident Geologist's Office, Thunder Bay.)

Kresz, D.U., Zayachivsky, B. and Oiye, S.H. 1989a. Precambrian geology of the northern Long Lake area (northern part), District of Thunder Bay; Ontario Geological Survey, Preliminary Map P.3126, scale 1:15 840.

——1989b. Precambrian geology of the northern Long Lake area (southern part), District of Thunder Bay; Ontario Geological Survey, Preliminary Map P.3127, scale 1:15 840.

Kristjansson, R.J., Gaudino, S.P. and White, T.N. 1989. Quaternary geology of the Geraldton–Longlac area, District of Thunder Bay; Ontario Geological Survey, Preliminary Map P.3132, scale 1:50 000.

Ontario Geological Survey 1989. Airborne electromagnetic and total intensity magnetic survey, Tashota–Geraldton–Longlac area; Ontario Geological Survey, Maps 81259 to 81348, scale 1:20 000.

Percival, J.A. 1989. A regional perspective of the Quetico metasedimentary belt, Superior Province, Canada; Canadian Journal of Earth Sciences, v.26, p.677-693.

Percival, J.A. and Williams, H.R. 1989. Late Archean Quetico accretionary complex, Superior Province, Canada; Geology, v.17, p.23-25.

Reilly, B.A. 1988. Structural analysis of the Paint Lake deformation zone, northern Ontario; unpublished MSc thesis, Brock University, St. Catharines, 189p.

Sutcliffe, R.H. 1989. Mineral variation in Proterozoic diabase sills and dykes at Lake Nipigon, Ontario; Canadian Mineralogist, v.27, p.67-79.

REFERENCES

Amukun, S.E. 1980. Geology of the Conglomerate Lake area, District of Thunder Bay; Ontario Geological Survey, Report 197, 101p.

Anglin, C.D. 1987. Geology, structure and geochemistry of gold mineralization in the Geraldton area, northwestern Ontario; unpublished MSc thesis, Memorial University of Newfoundland, St. John's, 283p.

Berger, B. 1989. Geology of the Toronto Lake area, District of Thunder Bay; Ontario Geological Survey, Open File Map 127, scale 1:15 840. (Available for viewing only at the Mines Library, Ontario Geological Survey and the Resident Geologist's Office, Thunder Bay.)

Burwash, E.M. 1933. Atigogama and Dillabough lakes area, a preliminary report; Canadian Mining Journal, November 1933, p.435-436.

Devaney, J.R. and Fralick, P.W. 1985. Regional sedimentology of the Namewaminikan group, northern Ontario: Archean fluvial fans, braided rivers, deltas, and an aquabasin; *in* Current Research, Part B, Geological Survey of Canada, Paper 85-1B, p.125-132.

Faust, D. 1973. The petrochemistry, petrology and the economic geology of and Archean mafic intrusion in Elmhirst Township; unpublished BSc thesis, Saint Francis Xavier University, Antigonish, Nova Scotia, 40p.

Hopkins, P.E. 1916. The Kowkash gold area (first report); Ontario Bureau of Mines, Annual Report, 1916, v.25, pt.1, p.264-274.

——1918. Ogahalla to Collins, on the National Transcontinental Railway, Ontario; Ontario Bureau of Mines, Annual Report, 1918, v.27, pt.1, p.187-199.

Mackasey, W.O. 1969. Summers Township, District of Thunder Bay; Ontario Department of Mines, Preliminary Map P.602, scale 1:15 480.

——1975. Geology of Dorothea, Sandra and Irwin townships, District of Thunder Bay; Ontario Division of Mines, Geological Report 122, 83p.

Mackasey, W.O. and Wallace, H. 1973. Elmhirst Township, District of Thunder Bay; Ontario Division of Mines, Preliminary Map P.801, scale 1:15 840.

——1978. Geology of Elmhirst and Rickaby townships, District of Thunder Bay; Ontario Geological Survey, Geoscience Report 168, 101p.

Mason, J.K., Hine, C.M., Speed, A.A., White, G.D., Kristjansson, F.J. and Thorleifson, L.H. 1988. Beardmore–Geraldton Resident Geologist's Area – 1987; *in* Report of Activities 1987, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 138, p.101-134.

Mason, J.K. and White, G.D. 1986. Gold occurrences, prospects, and deposits of the Beardmore–Geraldton area, districts of Thunder Bay and Cochrane; Ontario Geological Survey, Open File Report 5630, 680p., (2 volume set).

Mason, J.K., White, G.D., Speed, A.A. and Gaudino, S. 1989. Beardmore–Geraldton Resident Geologist's District – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.111-132.

Matheson, A.F. 1948. Bankfield and Tombill mines; *in* Structural Geology of Canadian Ore Deposits, Canadian Institute of Mining and Metallurgy Symposium Publication, Mercury Press Ltd., Montreal, p.401-406.

Ontario Geological Survey 1989. Airborne electromagnetic and total intensity magnetic survey, Tashota–Geraldton–Longlac area, District of Thunder Bay; Ontario Geological Survey, Maps 81 259 to 81 348, scale 1:20 000.

Patterson, G.C., Mason, J.K. and Schnieders, B.R. 1984. Thunder Bay Resident Geologist area, North Central Region; *in* Report of Activities 1983, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 117, p.47-106.

——1985. Thunder Bay Resident Geologist's area, North Central Region; *in* Report of Activities 1984, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 122, p.56-113.

Pye, E.G. 1951. Geology of the Errington Township, Little Longlac area; Ontario Department of Mines, Annual Report, 1951, v.60, pt.6, 140p.

Sage, R.P. 1983. Geology of the Chipman Lake area, districts of Thunder Bay and Cochrane; Ontario Geological Survey, Open File Report 5401, 80p.

Thurston, P.C. 1980. Geology of the northern Onaman Lake area, District of Thunder Bay; Ontario Geological Survey, Report 208, 81p.

Thurston, P.C., Carter, M.W. and Riley, R.A. 1969. Operation Fort Hope, Attwood–Caribou lakes sheet, districts of Kenora (Patricia Portion) and Thunder Bay; Ontario Department of Mines, Preliminary Map P.564, scale 1:126 720.

Wallace, H. 1978. Geology of the Opikeigen Lake area, District of Kenora (Patricia Portion); Ontario Geological Survey, Report 185, 85p.

——1981. Geology of the Miminiska Lake area, districts of Kenora (Patricia Portion) and Thunder Bay; Ontario Geological Survey, Report 214, 96p.

Williams, H.R. 1989. Geological studies in the Wabigoon, Quetico and Abitibi–Wawa subprovinces, Superior Province of Ontario, with emphasis on the structural development of the Beardmore–Geraldton belt; Ontario Geological Survey, Open File Report 5724, 189p.

7. Schreiber–Hemlo Resident Geologist's District—1989

B.R. Schnieders[1] and M.C. Smyk[2]

[1]Resident Geologist, Schreiber–Hemlo Resident Geologist's Office, Northwestern Region.

[2]Staff Geologist, Schreiber–Hemlo Resident Geologist's Office, Northwestern Region.

INTRODUCTION

The Schreiber–Hemlo District covers an area from the Nipigon River east to White River, and from the US–Canada border north to Upper Roslyn Lake and Kagiano Lake (*see* Figure 7.1). The area includes the communities of Rossport, Schreiber, Terrace Bay, Marathon, Heron Bay and Manitouwadge, and is adjacent to the communities of Nipigon and White River. The district incorporates the Schreiber–Winston Lake, Hemlo and Manitouwadge mining camps, which presently host five producing mines. The David Bell Mine, Golden Giant Mine and Williams Mine are the gold mines at Hemlo. The base metal mines include the Noranda Inc., Geco Division mine in Manitouwadge and the Minnova Inc., Winston Lake Division mine located north of Schreiber.

Mining highlights for 1989 include the estimated production of over 1150000 ounces of gold from the Hemlo mines. The Williams Mine was Canada's top gold producer in 1989 with a forecasted production of over 480000 ounces of gold, while the David Bell Mine is one of Canada's highest-grade producing gold mines, producing at a grade of approximately 0.78 ounce Au per tonne (0.71 ounce Au per ton). In August 1989, the Supreme Court of Canada awarded the Williams Mine, (formerly Page–Williams Mine) in Hemlo, developed by Lac Minerals Ltd., to Corona Corporation. This ended an eight-year legal battle for the largest underground gold mine in Canada. Corona Corporation and Teck Corporation, under a prior agreement, will become equal partners in the mine's operation. The mine will be operated by Williams Operating Corporation.

Exploration activity in the Schreiber–Hemlo District decreased slightly in 1989, compared to 1988, but remained at a competitive level. While exploration activity in the district decreased as a whole in 1989, the Manitouwadge camp was a high point with exploration activity increasing. This was due primarily to increased efforts of Geco Division, Noranda Inc. and Noranda Exploration Company, Limited, to develop new and additional ore reserves in the Manitouwadge area. Additional activity by prospectors and companies has been stimulated by the recent resurgence of base metal prices as well as by government programs.

Exploration for gold, base metals, platinum group elements (PGE) and industrial minerals was active in 1989. Over 1200 inquiries from the mining sector and general public were dealt with in the Thunder Bay office, Marathon field office and in the field. Several new occurrences were discovered by prospectors during 1989, including the Power Creek occurrence of W. Acker and R. Otto and the Pukatawagan Lake occurrence of R. Renner, P. Rowe and B. Comeau.

During 1989, the Ontario Mineral Exploration Program (OMEP) assisted one designated program in the Schreiber–Hemlo District with a total expenditure of $36125. As of December 1, 1989, eight prospectors in the Schreiber–Hemlo District had approved Ontario Prospector Assistance Program (OPAP) applications, totalling $61386 in grants.

ACKNOWLEDGMENTS

P. Sarvas, Drill Core Library Geologist, prepared the section on the Drill Core Library Program. Technical support and assistance for this report was provided by S. Warren who prepared assessment file data. C. Komar typed the original draft and K.G. Fenwick reviewed the manuscript.

Numerous prospectors, geologists and individuals from the mining sector provided valuable information and discussion throughout 1989 and many are referred to throughout the text.

All analytical work reported was performed by the Geoscience Laboratories Section, Ontario Geological Survey, Toronto, and Temiskaming Testing Laboratory, Ministry of Northern Development and Mines, Cobalt.

MINING ACTIVITY

Geco Division (Noranda Inc.)

Production from Geco Division mine, Manitouwadge, from July 30, 1988 to July 30, 1989, involved milling of 1418116 tons (short) of ore at a grade of 1.82 percent Cu, 3.40 percent Zn and 1.53 ounces Ag per ton.

Diluted ore reserve and grade estimates as of July 31, 1989, are listed in Table 7.1.

Winston Lake Division (Minnova Inc.)

The Minnova Inc. Winston Lake Division mine completed its first full year of production in 1989. Production for the period January 1989 to October 31, 1989, was 247493 t milled at a head grade of 0.84 percent Cu, 15.80 percent Zn, 28.16 g/t Ag and 1.07 g/t Au (R. Sim, Winston Lake Division, personal communication, 1989).

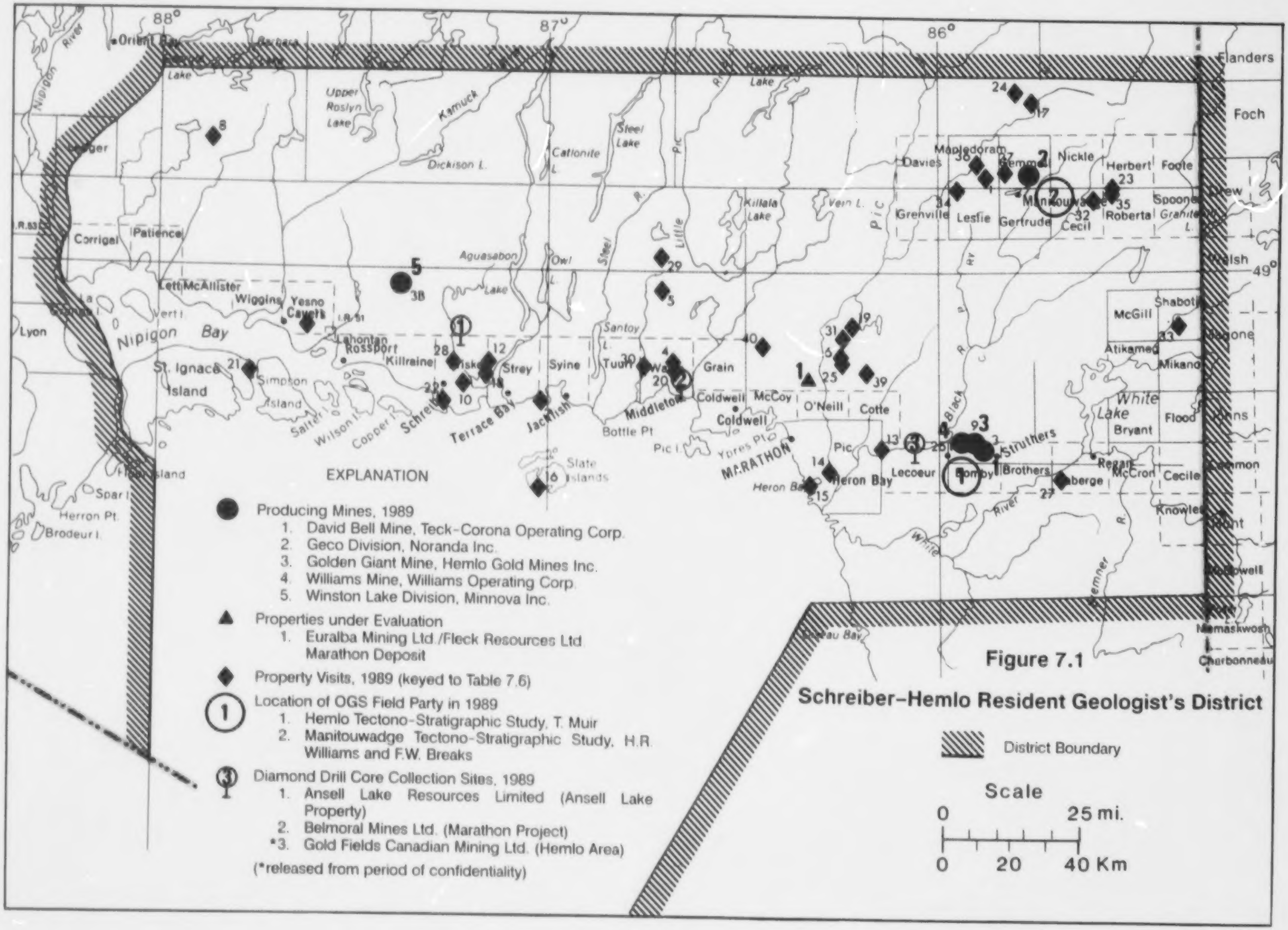

88°
87°
86°
49°
EXPLANATION
Producing Mines, 1989
1. David Bell Mine, Teck-Corona Operating Corp.
2. Geco Division, Noranda Inc.
3. Golden Giant Mine, Hemlo Gold Mines Inc.
4. Williams Mine, Williams Operating Corp.
5. Winston Lake Division, Minnova Inc.
Properties under Evaluation
1. Euralba Mining Ltd./Fleck Resources Ltd Marathon Deposit
Property Visits, 1989 (keyed to Table 7.6)
Location of OGS Field Party in 1989
1. Hemlo Tectono-Stratigraphic Study, T. Muir
2. Manitouwadge Tectono-Stratigraphic Study, H.R. Williams and F.W. Breaks
Diamond Drill Core Collection Sites, 1989
1. Ansell Lake Resources Limited (Ansell Lake Property)
2. Belmoral Mines Ltd. (Marathon Project)
*3. Gold Fields Canadian Mining Ltd. (Hemlo Area)
(*released from period of confidentiality)
District Boundary
Scale
0
25 mi.
0
20
40 Km
Nipigon Bay
St. Ignace Island
Simpson Island
Terrace Bay
Schreiber
Jackfish
Slate Islands
Bottle Pt
Pic I.
Ypres Pt.
MARATHON
Heron Bay
Coldwell
Middleton
Rossport
Lyon
Corrigal
Patience
Lett
McAllister
Wiggins
Yesno
Cavers
Lahontan
Killraine
Strey
Syine
Tuuri
Grain
McCoy
O'Neill
Cotte
Pic
Lecoeur
Bomby
Brothers
Laberge
Struthers
Davies
Grenville
Leslie
Gertrude
Cecil
Roberta
Herbert
Foote
Nickle
Spooner
Drew
Flanders
Foch
Walsh
McGill
Shabotik
Atikameg
Mikano
White Lake
Bryant
Flood
Regan
McCron
Cecile
Knowles
Common
Nemaskwosh
Charbonneau
Upper Roslyn Lake
Dickison L.
Cationite L.
Steel Lake
Killala Lake
Aguasabon
Owl L.
Santoy L.
Little
Pic
Black
White
Kamuck
Orient Bay
Nipigon River
Spar I.
Herron Pt.
Brodeur I.
Salter
Wilson I.
Copper I.
Vein L.
Santoy
Hemlo

Figure 7.1

Schreiber–Hemlo Resident Geologist's District

TABLE 7.1. ORE RESERVES AND GRADES, GECO DIVISION, NORANDA INC.

	Tons	Cu (%)	Zn (%)	Ag (oz./ton)
Main Orebody	9 179 754	1.70	3.11	1.24
4-2 Copper	1 788 287	1.84	0.55	0.60
8-2 Zinc	585 967	0.20	5.14	1.15
Zinc in Iron Formation (ZIF)	267 216	0.04	6.72	1.20
Total	11 821 224	1.61	2.90	1.13

(H. Lockwood, Geco Division, personal communication, 1989)

TABLE 7.2. ORE RESERVES AND GRADES, WILLIAMS MINE.

	Ore Reserves (t)	Grade (g/t)
A-Zone	1 000 000	6.9
B-Zone	31 000 000	6.8
C-Zone: Pit	1 700 000	4.1
Underground	1 600 000	5.1
Total	35 300 000	6.6

(B. Weicker, Page-Williams Mine, personal communication, 1988)

Reserve estimates which include proven, probable, possible and potential ore with a 20 percent dilution at zero percent grade are indicated at 2634903 t at a grade of 1.06 percent Cu, 15.00 percent Zn, 31.28 g/t Ag and 1.07 g/t Au. Estimated production in 1990 is 340000 t of ore (R. Sim, Winston Lake Division, personal communication, 1989).

HEMLO AREA MINES

Combined gold production from the three Hemlo mines in 1988 was 933860 ounces (Canadian Mines Handbook 1989–90) which represented approximately 50 percent of Ontario's total gold production and 23 percent of Canada's total gold production.

Combined gold production in 1989 from the three Hemlo mines is estimated to be greater than 1150000 ounces.

David Bell Mine (Teck-Corona Operating Corporation)

Production from the David Bell Mine from January 1989 through September 30, 1989, consisted of 240337 ounces of gold from 316622 t milled at a grade of 0.785 ounce Au per tonne (0.71 ounce Au per ton) (P. Bankes, David Bell Mine, personal communication, 1989).

Mineable, diluted and recoverable ore reserve estimates as of January 1, 1989, were 8072300 tons averaging 0.373 ounce Au per ton (Canadian Mines Handbook 1989–90) (7323000 t at 0.41 ounce Au per tonne; P. Bankes, David Bell Mine, personal communication, 1989). Geological reserves in the one-quarter claim owned by Hemlo Gold Mines Inc. were 2056800 tons averaging 0.332 ounce Au per ton (Canadian Mines Handbook 1989–90).

Golden Giant Mine (Hemlo Gold Mines Inc.)

Production from the Golden Giant Mine from January 1989 through October 31, 1989, was 326781 ounces of gold from 849313 t milled at a grade of 12.376 g/t (B. Kusins, Golden Giant Mine, personal communication, 1989). Forecasted production to the end of 1989 is estimated to be 385990 ounces of gold.

Ore reserve estimates as of January 1, 1989, were 18026487 t at a grade of 10.85 g/t (B. Kusins, Golden Giant Mine, personal communication, 1989).

Williams Mine (Williams Operating Corporation)

Production from the Williams Mine from January 1989 through October 31, 1989 was 410809 ounces of gold from 1573564 t milled at a grade of 8.12 g/t (0.261 ounce Au per ton) (A. Guthrie, Williams Mine, personal communication, 1989). The mill averaged 5176 t per calendar day and had a recovery of 95.1 percent up to October 31, 1989.

Undiluted ore reserve estimates for the Williams Mine as of November 1988 (formerly Page-Williams) total 35300000 t at a grade of 6.6 g/t (0.19 ounce Au per ton). The breakdown of ore reserves is listed in Table 7.2.

ADVANCED EXPLORATION AND DEVELOPMENT

Euralba Mining Ltd.-Fleck Resources Ltd.

During September and October 1989, Euralba Mining Ltd. (51%), in conjunction with Fleck Resources Ltd. (49%), conducted a field program on their Marathon copper-PGE project. Further power stripping by backhoe and hydraulic washing, as well as diamond saw channel sampling, was undertaken in order to determine continuity of the surface mineralized zone. This program was directed at evaluating an additional shallow ore zone to the north of the currently delineated ore reserves.

Concentrate from the 1985 and 1986 bench tests and pilot plant tests at Lakefield Research is in the process of being shipped offshore for pilot smelter testing, using the Pyrogold plasma arc furnace pyrometallurgical process.

To enable Euralba to include this additional work in their study, Fleck Resources Ltd. has agreed to grant an extension of the option agreement dated June 15, 1987, from November 30, 1989 to November 30, 1990 (J. McGoran, Fleck Resources Ltd., personal communication, 1989).

EXPLORATION ACTIVITY

Exploration activity in the Schreiber–Hemlo District expressed by the number of active programs decreased slightly in 1989 compared to 1988 (*see* Table 7.3). There

TABLE 7.3. EXPLORATION ACTIVITY IN THE SCHREIBER-HEMLO DISTRICT (EXPRESSED AS PERCENTAGE OF PROGRAMS).

Commodity	1987	1988	1989
Gold/Silver (Au & Ag)	70%	61%	45%
Base Metals (Cu & Zn & Ag)	14%	18%	34%
Platinum Group Elements (PGE & Ni & Cu)	14%	9%	3%
Industrial Minerals Building Stone, Amethyst, Rare Earth Elements (REE)	2%	12%	18%
Total Number of Active Exploration Programs	51	60	56

were 56 active programs (*see* Table 7.4, Figure 7.2) exploring for gold and/or silver, base metals, PGE, and industrial minerals. A marked decline in exploration activity by junior companies was clearly evident in 1989, while senior mining companies and prospectors remained quite active. Noranda Exploration Company, Limited, Geco Division, Noranda Inc. and Hemlo Gold Mines Inc. accounted for 20 active exploration programs in 1989 which totalled over one-third of the total exploration activity.

Exploration for gold still predominated in 1989, but declined compared to 1988. Gold will likely continue to represent the dominant commodity explored for, especially due to the spectacular production and potential of the Hemlo gold camp. Base metal exploration continued to become more significant due to increased efforts in response to Canada's declining base metal reserves and more locally related to declining ore reserves at the Geco Division mine of Noranda Inc. in Manitouwadge.

Exploration for PGE decreased in 1989, while industrial minerals projects again increased and remained an important exploration commodity. Exploration of rare earth element (REE) properties was inactive in 1989.

A summary of the claims recorded and assessment work for the Thunder Bay Mining Division is available in Table 5.1 (*see* Lavigne et al., this volume).

GOLD EXPLORATION

Gold exploration accounted for 45 percent of the 1989 exploration programs in the Schreiber-Hemlo District. Exploration activity for gold declined in the Hemlo area with 12 active programs in 1989 compared to 20 programs in 1988. Hemlo Gold Mines Inc. (*see* Table 7.3) had four active properties in 1989 including the International Interlake Industries Inc. property.

The International Interlake Industries Inc. Hemlo property comprises 31 contiguous claims, located immediately northwest of the Williams property. The Interlake property was being explored under an option agreement with a joint venture group composed of Hemlo Gold Mines Inc. and Teck Corporation which was terminated April 1989. From September 1983 to March 1989, six master holes with ten subsequent wedges were drilled for a total of 28118 m. The best intersection on the property was an 8 m section returning 9.34 g/t Au (0.273 ounce Au per ton) including 1 m of 18.59 g/t Au (0.543 ounce Au per ton) from a drill depth of 2438 to 2446 m. Estimates by the joint venture indicate the property to date contains drill-indicated reserves of approximately 3000000 t averaging 0.24 ounce Au per tonne occurring at depths of 1000 to 2500 m below the surface (J.D. Hamilton, International Interlake Industries Inc., personal communication, 1989).

Hemlo Gold Mines Inc. shifted considerable exploration activity in 1989 to the Mishibishu-Wawa area.

Lac Minerals Ltd. continued exploration on its White River prospect in Bomby, Brothers and Laberge townships with a program of line cutting, geophysical surveys including induced polarization (IP), very low frequency (VLF) and magnetic (Mag), minor stripping and trenching, and diamond drilling. Lac expanded its land holdings east of the White River prospect in Abraham, Hunt and Cooper townships (The Northern Miner, November 13, 1989, p.1-2). An airborne geophysical survey was flown over a block of approximately 650 claims.

Bond Gold Canada Inc. conducted a diamond drilling program on its Hemlo west property.

Noront Resources Ltd. completed an airborne geophysical survey (electromagnetic (EM), Mag) on its 57-claim Bremner River property in McCron Township. Previous geochemical soil surveys defined an anomalous zone 1300 m in length coincident with an airborne VLF-EM conductor. The 1989 exploration program has been budgeted at $100000 and includes geological, geophysical and geochemical surveys with follow-up diamond drilling. (M. Kearney, Dominion Explorers Inc., personal communication, 1989.)

Noront's Rous Lake property comprises 128 claims divided into two groups. Group I consists of 20 claims on Rous Lake, optional to Noront by Central Crude Limited. Group II comprises 108 claims in Lecours Township, owned jointly by Noront Resources Ltd. and Central Crude. Recently, an airborne geophysical survey (EM, Mag) was completed and ground geophysical surveys (VLF, Mag, IP) and follow-up drilling are budgeted for 1990. (M. Kearney, Dominion Explorers Inc., personal communication, 1989.)

Teck Corporation carried out diamond drilling on its Heron Bay property. The drill program tested geophysical IP targets for extensions of mineralized horizons along strike west from the Peekongay-Heron Bay Mine property.

V. Stenlund was in negotiations with several companies on the Heron Bay-Peekongay Mine property near Heron Bay as of November 1989.

In the Schreiber-Terrace Bay area, Orevco Inc. carried out line cutting and geophysical surveys (VLF) on

TABLE 7.4. SCHREIBER-HEMLO RESIDENT GEOLOGIST'S DISTRICT—EXPLORATION ACTIVITY.

ABBREVIATIONS

AEM	Airborne electromagnetic survey
AMag	Airborne magnetometer survey
ARad	Airborne radiometric survey
DDH	Diamond-drill hole
EM	Electromagnetic survey
HL-EM	Horizontal-loop electromagnetic survey
IP	Induced polarization survey
Mag	Magnetometer survey
Res	Resistivity survey
Rad	Radiometric survey
UG	Underground work
VLF	Very Low Frequency

Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
1. Alymer Mines Ltd. (Tchorewski, Joseph)	Solong Lake Project	Wabikoba Lake & White Lake (North) areas	VLF-EM, Mag
2. Ansell Lake Resources Ltd.	Ansell Lake Property	Priske Township, Lower Aguasabon Lake Area	continuing exploration, DDH
3. Armeno Resources Inc.	MNW Property	Hanson Lake Area	VLF-EM, Rad, sampling, assays
4. Belmoral Mines Ltd.	Marathon Project	Walsh Township	DDH
5. Bond Gold Canada Inc.	Hemlo West Property	Lecours Township	DDH
6. Carlson Mines Ltd./ Black Gregor Explorations Ltd./ Nexus Resource Corporation	Wire Lake Property	Lorna Lake Area	geophysical survey, DDH
7. Carroll, Daniel	Spruce Bay Property	White Lake (North) Area	blasting, trenching
8. Cold Spring Granite (Canada) Limited	Angler Property	McCoy and Pic townships	DDH, geophysical survey
9. Cold Spring Granite (Canada) Limited	Coldwell Property	Coldwell Township	DDH, geophysical survey
10. Cold Spring Granite (Canada) Limited	O'Neill Black Property	Pic Township	DDH
11. Dampier, Gerard	Kabamichigama Lake Property	Kabamichigama Lake Area	power stripping
12. Esso Resources Canada Ltd.	Enterprise Property	Wabikoba Lake Area	VLF-EM, Mag
13. Euralba Mining Ltd./ Fleck Resources Ltd.	Marathon Deposit	Seeley Lake Area	stripping, hydraulic washing, channel sampling, feasibility study, geostatistical analysis
14. Fournier, Elwood	Wabasta Lake Property	Yesno Township	DDH
15. Hemlo Gold Mines Inc./Teck Corporation	International Interlake Property	Bomby Township	DDH
16. Hemlo Gold Mines Inc.	Maple Leaf Property	Mussy Lake Area	line cutting, prospecting, Mag, EM, soil geochemistry, geological mapping, sampling
17. Hemlo Gold Mines Inc.	Mussy Creek Property	Pic Township	airborne geophysical survey (Dighem), geological mapping, prospecting, sampling
18. Hemlo Gold Mines Inc.	Pic River Property	Pic Township	lithogeochem survey, geological mapping
19. Joa, Melvin	Hays Lake Property (Joa-Walton Property)	Priske Township	stripping, sampling, line cutting, geological mapping, Mag, VLF

TABLE 7.4. CONTINUED.

Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
20. Kukkee, David	Glacier Creek Property (Potter)	Cosgrave Lake Area	trenching, stripping, sampling
21. Lac Minerals Ltd.	Page-Williams Mine (C-Zone)	Bomby Township	o/b stripping, DDH
22. Lac Minerals Ltd.	White River Prospect	Brothers and Laberge townships	DDH, line cutting, IP, VLF, Mag, AEM, AMag (Aerodat), minor stripping, trenching
23. Laporte, Eldon	Kabamichigama Lake Property	Kabamichigama Lake Area	stripping, sampling
24. Michano, Duncan	Dead Horse Creek Property	Walsh Township	trenching, stripping
25. Minnova Inc.	Man-Echo Property	Mapledoram Township	line cutting, geological mapping, lithogeochem surveys, deep EM
26. Minnova Inc.	Winston Lake Project	Pays Plat Lake Area, Rope Lake Area	geological mapping, DDH, o/b stripping, deep EM, borehole pulse EM, lithogeochem survey
27. Noramco Explorations Inc.	Gionet (Shabotik) Property	Shabotik Township	stripping/trenching, channel sampling, sampling, Mag, VLF-EM, line cutting, IP, mapping, soil geochemistry
28. Noranda Exploration Company, Ltd.	Claim Group K-1	Killala Lake Area	lithogeochem survey, soil geochemistry, geology, geophysics
29. Noranda Exploration Company, Ltd.	Janet Lake Property	Mapledoram Township	geophysics, geology, geochemistry
30. Noranda Exploration Company, Ltd.	Kabamichigama Property	Kabamichigama Lake Area	geology
31. Noranda Exploration Company, Ltd.	Martinet Property	Martinet Lake Area	geophysics, geology, geochemistry
32. Noranda Exploration Company, Ltd.	Moschuk Property	Blair Lake Area	line cutting, prospecting, trenching, sampling
33. Noranda Exploration Company, Ltd.	Nama Creek Property	Mapledoram Township	geology, geophysics, geochemistry
34. Noranda Exploration Company, Ltd.	Newjay Property	Wabikoba Lake Area	lithogeochem, soil geochemistry
35. Noranda Exploration Company, Ltd.	North Shores Property	Priske Township	prospecting, mapping, trenching, geochemistry, sampling

TABLE 7.4. CONTINUED.

Company/Individual(s) Exploration	Property Name	Township/Area	Work Done
36. Noranda Exploration Company, Ltd.	Page Lake Property	Seeley Lake and Lorna Lake areas	prospecting, sampling, rock/soil geochemistry
37. Noranda Exploration Company, Ltd.	Pukatawagan Lake Property	Cirrus Lake and Martinet Lake areas	line cutting
38. Noranda Exploration Company, Ltd.	Rhumly (Rumpty) Lake Property	Lower Aguasabon Lake Area	prospecting, mapping, sampling, geochemistry
39. Noranda Exploration Company, Ltd./ Cumberland Resources Limited	Prairie River/ Marlhill Property	Tuuri and Walsh townships	prospecting, DDH, geological mapping, sampling
40. Noranda Inc. (Geco Division)	North Faries Project	Cecil and Nickle townships	mapping, line cutting, lithogeochem, Mag, HL-EM
41. Noranda Inc. (Geco Division)	Sand Lake Project	Leslie Township	reconnaissance prospecting
42. Noranda Inc. (Geco Division)	South Iron Formation	Mapledoram and Gemmell townships	line cutting, geological mapping, lithogeochem
43. Noranda Inc. (Geco Division)	Willroy Project	Mapledoram Township	line cutting, geological mapping, lithogeochem
44. Noront Resources Ltd. (Dominion Explorers Inc.)	Bremner River Property	McCron Township	AEM, AMag
45. Noront Resources Ltd. (Dominion Explorers Inc.)/ Central Crude Limited	Rous Lake Property	Lecours Township	AEM, AMag
46. Orevco Inc.	Johnston-McKenna Property	Priske Township	line cutting
47. Palin Granite Canada Inc.	Culhane Property	Pic Township	AEM, Mag, VLF
48. Placer Dome Inc.	Stankey Option (Schreiber-Pyramid Property)	Priske Township	line cutting, mapping, trenching, stripping, sampling
49. Renner, Russel	Pukatawagan Lake Property	Cirrus Lake and Martinet Lake areas	prospecting, stripping, trenching, sampling
50. Rio Algom Exploration Inc.	Rope Lake Property	Rope Lake Area Area	line cutting, geophysics, Mag, HL-EM, DDH
51. Savage, James	Klersy Lake Property	Kabamichigama Lake Area	trenching, sampling
52. Seeber, Walter/ Digregorio, Silvio	Quarry Island Property	Lahontan Township	DDH
53. Teck Corporation	Heron Bay Property	Pic Township	DDH
54. Thorsteinson, Edward	Arrell Lake Property	Arrell Lake Area	power stripping
55. Zenmac Zinc Ltd. (Cameco Option)	Bozena Lake Property	Tuuri Township	DDH
56. 502095 Ontario Ltd.		Lecours Township and Wabikoba Lake Area	power stripping

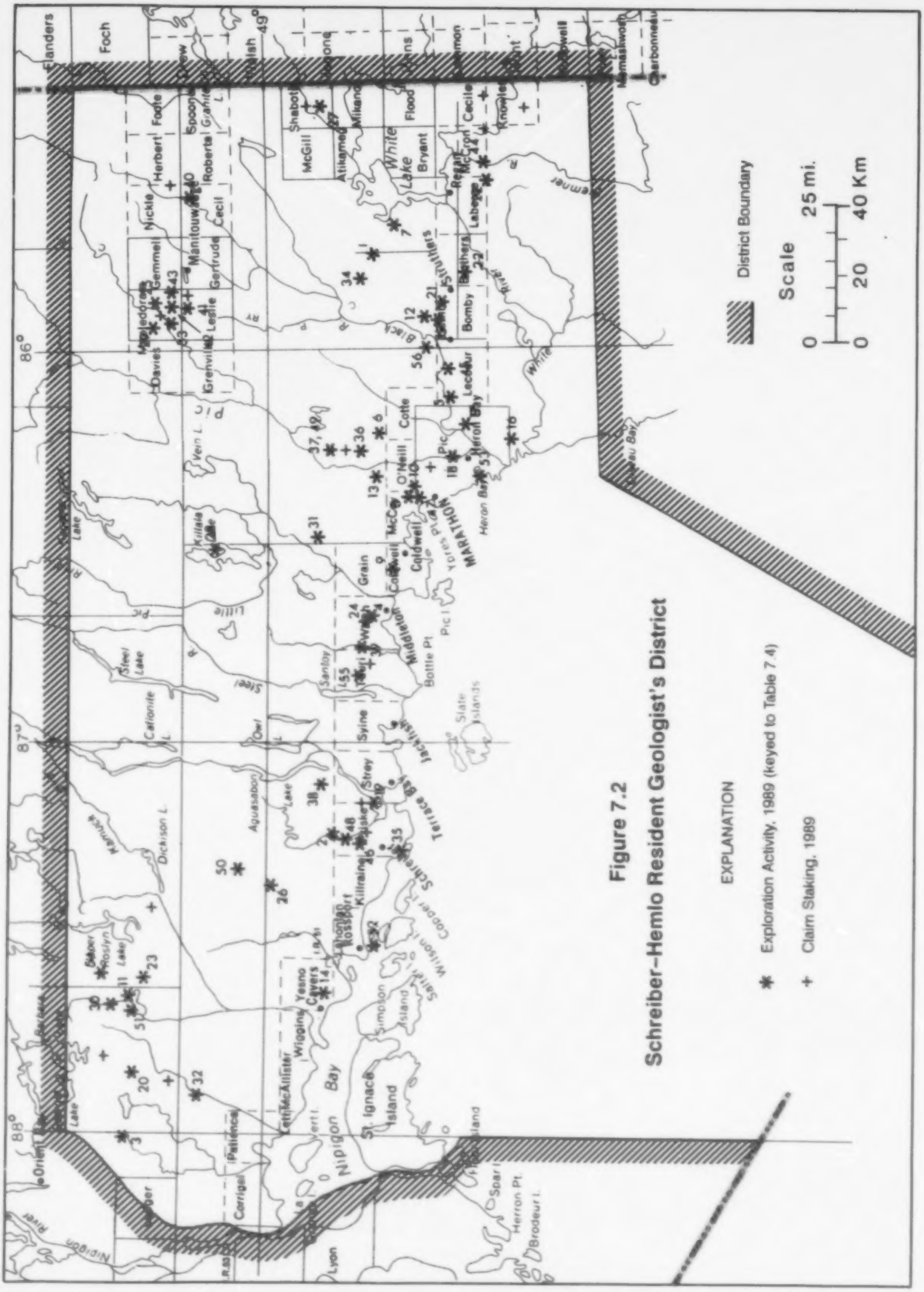

88°
87°
86°
49°
Nipigon Bay
St. Ignace Island
Simpson Island
Wilson I.
Copper I.
Slate Islands
Terrace Bay
Schreiber
Rossport
Jackfish
Marathon
Heron Bay
Pic
Caldwell
Mobert
White Lake
Steel Lake
Little Pic R.
Vein L.
Aguasabon Lake
Dickison L.
Nipigon River
Nipigon
Red Rock
Orient Bay
Foch
Flanders
Walsh
Davies
Gemmell
Nickle
Herbert
Foote
Roberts
Cecil
Gertrude
Leslie
Grenville
Manitouwadge
McGill
Atikameg
Mikano
Bryant
Bomby
Brothers
Laberge
Lecours
Cotte
O'Neill
McCoy
Grain
Syine
Santoy
Middleton
Killraine
Strey
Wiggins
Yesno
Cavers
Corrigal
Patience
McAllister
Lyon
Spar I.
Herron Pt.
Brodeur I.
District Boundary
Scale
0
25 mi.
0
20
40 Km

Figure 7.2

Schreiber–Hemlo Resident Geologist's District

EXPLANATION

* Exploration Activity, 1989 (keyed to Table 7.4)

\+ Claim Staking, 1989

the Johnston–McKenna property. Plans for 1990 include stripping, trenching and bulk sampling with possible small-scale mining applications.

M. Joa and R. Walton conducted stripping, sampling, line cutting, geological mapping and geophysical surveys (Mag, VLF) on their Joa–Walton occurrence on the east shore of Hays Lake. Several new veins and a copper-rich porphyry zone were discovered in 1989. Selected grab samples from the stripped main No. 1 vein assayed up to 9.86 ounces Au per ton and 17.12 ounces Ag per ton.

W. Acker and R. Otto discovered a new vein system and gold associated with iron formation at the Power Creek occurrence (*see* Property Examinations section).

Noranda Exploration Company, Limited, continued exploration on the North Shore Mine/Worthington Bay property. Exploration consisted of prospecting, trenching, sampling, geological mapping and geochemical surveys. Several thousand ounces of gold were produced from high-grade quartz veins during intermittent production from 1900 to the 1940s.

The Big Duck Lake property of Minnova Inc. remained dormant in 1989. However, a program has been outlined pending a potential joint venture agreement.

BASE METAL EXPLORATION

Base metal exploration once again displayed a marked increase in 1989 accounting for 35 percent of the active programs. Three main areas were responsible for this increase including the Manitouwadge area, Santoy Lake–McKellar Lake area and Winston Lake area.

Geco Division, Noranda Inc., increased its base metal exploration activity in 1989. Present ore reserves at the Geco Division mine, Noranda Inc., give the mine a life expectancy of approximately eight years. Noranda Exploration Company, Limited, in conjunction with Geco Division flew a Dighem airborne geophysical survey covering the Marathon–Manitouwadge–Hornepayne area. Noranda Exploration will be involved with a two-year ground follow-up program. Geco Division, Noranda Inc., was active both on surface and underground at the Geco Mine in 1989. Exploration continues within the synform to the west on the Willroy and Willecho mines properties and to the east in Cecil and Roberta townships to test for continuation of the volcanic sequence and mine series. In total, Geco Division, Noranda Inc., and Noranda Exploration Company, Limited, have 11 active base metal projects within a 50 km radius of Manitouwadge; this level of activity is predicted to continue for the next several years.

Minnova Inc. conducted line cutting, geological mapping, lithogeochemical and geophysical surveys (deep EM loops) on its Man–Echo property on the north limb of the Manitouwadge synform. Drilling is scheduled for early 1990.

The second active base metal area is the Winston Lake Mine area of Minnova Inc. Minnova conducted 11523 m of drilling in 1989 incorporating 20 holes on a number of targets including the Pick Lake zone, Gesic area and other targets within the Winston Lake sequence. Drilling on the Pick Lake zone continued to intersect a thin, high-grade, massive sulphide sheet. In addition, drilling was undertaken in the gabbro to try to identify additional massive sulphide rafts and lenses. Minnova Inc. also undertook detailed geological mapping, sampling, lithogeochemical surveys, deep EM (transient pulse) geophysical surveys, borehole plus EM surveys, and stripping on the property.

Diamond drilling on the Prairie River–Marlhill property in the Santoy Lake–McKellar Lake area by Noranda Exploration Company, Limited, and Cumberland Resources Ltd. intersected encouraging base metals values on hole MH-88-01. The results are listed in Table 7.5.

The 3000 m long Prairie River–Marlhill horizon includes a 200 m wide quartz-sericite schist representing part of a copper-zinc-magnesium-enriched, sodium-depleted volcanogenic massive sulphide alteration and stringer zone (Cumberland Resources Ltd., news release, Vancouver Stockwatch, November 15, 1989) (Schnieders and Smyk 1989). Diamond drilling was slated for December 1989.

PLATINUM GROUP ELEMENTS EXPLORATION

Exploration activity in the Coldwell and Killala Lake alkalic complexes decreased in 1989 with Euralba Mining Ltd.–Fleck Resources Ltd. being the only active exploration project. As reported earlier, the Marathon deposit underwent power stripping, hydraulic washing and

TABLE 7.5. HOLE MH–88–01. DIAMOND–DRILL HOLE INTERSECTIONS AND ASSAYS, PRAIRIE RIVER–MARLHILL PROPERTY.

From	To (ft.)	Length (%)	Zn (%)	Cu (g/t)	Ag (g/t)	Au
739.2	753.6	14.4	1.22	0.06	3.3	0.13
799.6	802.9	3.3	2.06	0.09	3.8	0.14
822.5	858.5	36.0	1.04	0.04	2.8	<0.07
includes		3.3	5.06	0.27	11.5	<0.07
1180.8	1184.1	3.3	0.08	1.8	18.5	<0.07

Hole MH–88–02 collared 1219 m (4000 feet) along strike of hole; 88–01 intersected 3.3 feet of 3.15 percent Zn, 1.12 percent Cu, 38.0 g/t Ag and 0.27 g/t Au.
(Cumberland Resources Ltd., News Release, February 21, 1989)

sampling. An extension to the option has been granted to Euralba Mining Ltd. to November 30, 1990.

The MacRae or Geordie Lake occurrence, located approximately 15 km northwest of Marathon, remained dormant during 1989. The copper-palladium-bismuth-tellurium-silver occurrence (Schnieders and Smyk 1989; Mulja 1989) is presently held by M. Joa and G. MacRae of Marathon.

Noramco Explorations Ltd. had the most aggressive exploration program, conducting line cutting, stripping, hydraulic washing, trenching, channel sampling, geophysical surveys (Mag, VLF-EM, IP), geological mapping and soil geochemistry surveys on its Gionet PGE occurrence in Shabotik Township.

INDUSTRIAL MINERALS EXPLORATION

Nine exploration programs for industrial minerals; e.g., building and dimension stone, amethyst, silica and lithium were active in the Schreiber-Hemlo District during 1989 (*see* Table 7.3). A further discussion on industrial minerals and program information can be found in Gerow and Bellinger (this volume).

RARE EARTH ELEMENTS EXPLORATION

Exploration of REE properties was inactive during 1989.

GENERAL GEOLOGY

The Schreiber-Hemlo District is underlain by Early to Late Precambrian rocks. The Archean rocks represent a portion of the Abitibi-Wawa Subprovince of the Superior structural province in contact with the Quetico Subprovince in the extreme northern section of the area. The Abitibi-Wawa Subprovince is a supracrustal metavolcanic-metasedimentary sequence which has been intruded by granitic-syenitic plutons and metagabbroic dikes and sills.

The supracrustal rocks occur in three "main" belts within the Schreiber-Hemlo District: 1) the Schreiber-Terrace Bay-Winston Lake area, previously described by Marmont (1984), Severin and Balint (1985), and Patterson et al. (1987); 2) the Cirrus Lake-Heron Bay-Hemlo area, previously described by Milne (1967), Muir (1982a, 1982b) and Patterson (1984); and 3) the Manitouwadge area, previously described by Pye (1960) and Friesen et al. (1982).

The metavolcanic rocks within the Schreiber-Hemlo District vary from calc-alkalic pyroclastic rocks, breccias, tuffs, flows, porphyritic flows, schists and gneisses to mafic, iron-rich tholeiites which include pillowed and massive flows, tuffs, schists and gneisses. The metasedimentary rocks consist of graded turbidites, wackes, mudstones, schists, paragneisses, minor conglomerates and iron formation. Sulphide-facies iron formation predominates in the Schreiber-Terrace Bay area, while oxide-silicate facies appears to predominate in the Manitouwadge area. Numerous felsic batholiths, plutons, stocks and porphyry dikes, including the Terrace Bay batholith, Heron Bay pluton and Cedar Lake pluton, intrude the supracrustal rocks. The supracrustal rocks have been metamorphosed under low-grade (greenschist facies) conditions in the Schreiber, Jackfish, Big Duck and Heron Bay areas, under medium grade (amphibolite facies) in the Winston Lake and Hemlo areas, and under medium to higher grade (upper amphibolite facies) in the Manitouwadge area.

The supracrustal rocks have undergone up to four periods of deformation (Muir and Elliot 1987). Two periods of folding are evident in the Hemlo area, while evidence of multiple or complex folding events is present in the Lower Steel River area (Schnieders 1987). Large-scale faulting and deformation zones have been recognized in the Hemlo area by Page (1947), Bartley and Page (1958), Hugon (1984, 1986) and Muir and Elliot (1987); in the Big Duck Lake area by Williams (1986, 1987, 1988, 1989); and in the Jackfish-Middleton area by Williams (1987, 1989) and Schnieders (1987).

Middle Precambrian rocks unconformably overlie the Early Precambrian rocks. The Gunflint and Rove Formation sedimentary rocks consist of conglomerate, black shale and iron formation.

Late Precambrian sedimentary rocks unconformably overlie Early and Middle Precambrian rocks. The Sibley group consists of conglomerate, sandstone, shale, carbonates and chert. Keweenawan rocks are represented by diabase dikes and sills, and mafic to felsic volcanic and sedimentary rocks (Osler Group) in the Nipigon Bay-Schreiber Channel area. Late Precambrian intrusive rocks include alkalic and carbonatite complexes such as the Coldwell and Killala alkalic complexes and the Prairie Lake carbonatite, as well as mafic to felsic dikes.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The Schreiber-Hemlo Resident Geologist's office is staffed by B.R. Schnieders, Resident Geologist and M.C. Smyk, Staff Geologist. The Resident's office operates from the Mines and Minerals Division office in Thunder Bay. A field office was maintained at the office of the Northern Development Officer (NDO), Ministry of Northern Development and Mines in Marathon from May through October 1989. This field office was manned by a geologist every Tuesday from 1 to 5 p.m.

During 1989, the Schreiber-Hemlo Program dealt with approximately 1200 inquiries from the mining sector and general public, including 710 visitations and 500 phone inquiries. Included in this total were 77 visitations and 62 phone inquiries at the Marathon field office. A total of 47 visits to 40 properties (*see* Table 7.6, Figure 7.1) were conducted, including 3 underground mine tours. In addition, 13 oral presentations, 2 poster displays and 12 field trips were conducted at various seminars or for groups and organizations. Basic prospecting courses, involving 18 and 30 hours of classes, were given in Marathon and Thunder Bay, respectively, attracting over 20 participants at each location. The Thunder Bay

TABLE 7.6. PROPERTY EXAMINATIONS–1989.

1. Big Nama Mine
2. Cape Victoria
3. David Bell Mine
4. Dead Horse Creek REE
5. Dead Horse Creek Road
6. Fallen Fault Lake
7. Geco Division Mine
8. Glacier Creek (Kukkee)
9. Golden Giant Mine
10. Gold Range/Harkness–Hays mines
11. Halonen Amethyst
12. Hays Lake (W2 Shear Zone)
13. Hemlo West (Bond Gold)
14. Heron Bay (Peekongay)
15. Heron Bay (Teck)
16. Horace Cove
17. Husak Road
18. Joa–Walton
19. Louis Lake (South)
20. Michano (Dead Horse)
21. Moffat Strait
22. Morley: High Grade, Pyrite, Road
23. Moshkinabi Lake
24. Olson Road
25. Page Lake
26. (Page–) Williams Mine
27. Pickerel Bay
28. Power Creek
29. Prairie Lake Carbonatite
30. Prairie River (Marlhill)
31. Pukatawagan–Roccian Lakes
32. Rawluk Lake
33. Shabotik (Gionet)
34. Swill Lake
35. Wagush Lake
36. Willecho Mine
37. Willroy Mine
38. Winston Lake Division Mine
39. Wire Lake
40. Wullie Lake

course was given in conjunction with the Thunder Bay Resident Geologist's Program. An Advanced Base Metals Prospecting Course, involving 9 hours of classes, was conducted in Manitouwadge and attracted over 30 participants. During October, a prospectors field trip was conducted in conjunction with Geco Division, Noranda Inc., the Ontario Geological Survey, and the Manitouwadge Recreation Department in Manitouwadge and attracted 15 participants. Several field trips were made with Ontario Geological Survey crews: F. Breaks and H. Williams in the Manitouwadge area and T. Muir in the Hemlo area. In addition, five conferences or seminars were attended or contributed to, and several professional development seminars were attended. One radio interview and four newspaper interviews were conducted in 1989.

The Schreiber–Terrace Bay mineral occurrence compilation is still ongoing and the expected completion of this report, including more than 125 occurrences, is projected for fall 1990 or spring 1991. The Manitouwadge–Marathon–Hemlo mineral occurrence compilation began in 1989; the report will likely take four to five years to produce.

The 1989 Northwestern Ontario Mines and Minerals Symposium was organized and hosted in Thunder Bay in February 1989 and was attended by over 400 participants.

M. O'Brien, Resource Geologist, prepared Geological Data Inventory Folios (GDIFs), assisted in a GDIF poster display and provided assessment file supervision and office organization, as well as representing and updating the MNDM Northwestern Region corporate display at several conferences. In addition, the Mines and Minerals statistic sheets were updated and media gleanings initiated. S. Warren maintained and supervised the assessment files and assisted in GDIF updating and office and library organization. The Assessment Files office dealt with 700 visitors and 100 phone inquiries during 1989.

C. Komar and D. Chiasson provided clerical assistance and support in Thunder Bay and Marathon, respectively. C. Komar assisted with the organization and registration of the Northwestern Ontario Mines and Minerals Symposium.

PROPERTY EXAMINATIONS – 1989

Swill Lake Property

Swill Lake is located approximately 9 km west of Manitouwadge in Leslie Township. Recent logging activities have significantly created and improved access which has helped lead to a resurgence in local staking and exploration activity.

The property held currently by A. Turner of Manitouwadge lies in the "nose" or hinge of the Manitouwadge synform, straddling the contact between mafic metavolcanic rocks to the south and metasedimentary rocks to the north (Pye 1960). It has been suggested that some of the mapped metasedimentary rocks may be felsic volcanic rocks. Recognition of the protolith is locally hampered by amphibolite facies metamorphism and pervasive deformation.

Local rocks consist of intercalated biotitic quartzofeldspathic schists and gneisses (metasediments) and hornblende schist and amphibolite (mafic volcanic rocks). Foliations are steeply dipping and strike at 065°. Minor quartz veins are boudinaged and rodded. Amphibolite dikes are folded and have shallow northeast-trending fold axes.

Fine-grained, disseminated to wispy pyrite is ubiquitous and occurs in amounts much less than 1 percent. Amphibole clots and spotty feldspathization may be associated with the sulphides. A sample of this mineralization returned 0.013 percent Cu, 0.002 percent Zn, trace Au and nil Ag.

The unit of most interest consists of dark grey-green massive to banded, fine-grained amphibolite. Garnet-rich (up to 75 percent) bands, typically aver-

TABLE 7.7. ANALYTICAL RESULTS, SWILL LAKE.

	Swill Lake* (89BAT-02) (%)	Hornblende Schist** (%)
SiO_2	50.2	51.08
Al_2O_3	12.3	14.99
Fe_2O_3	19.0	1.57
FeO	--	11.25
MgO	5.58	5.59
CaO	6.43	8.36
Na_2O	0.50	2.24
K_2O	1.16	0.44
TiO_2	2.76	1.55
P_2O_5	0.42	0.10
MnO	0.34	0.27
CO_2	0.15	1.45
S	0.05	
LOI	0.4	
TOTAL	99.0	99.89
Zn	830 ppm	
Cu	8 ppm	

**Geoscience Laboratories, Ontario Geological Survey, Toronto*
***No. 3–Average analysis of hornblende schist unit, Manitouwadge area (Pye 1960)*

aging 15 to 30 cm in width, may compose 50 percent of an outcrop. The bands consist of irregular to round porphyroblastic quartz-garnet aggregates, 0.25 to 2 cm in diameter. A foliation is developed in biotitic envelopes which wrap around the quartz-garnet porphyroblasts. Irregular quartz veinlets and pods are widely distributed. Whole rock lithogeochemical results are shown in Table 7.7. Note the marked depletion in Na_2O, the enrichment in total Fe and K_2O and the elevated Zn value.

The mineralogy and geochemistry strongly suggest that the original mafic volcanic rocks have been hydrothermally altered in a similar fashion to those associated with volcanogenic base metal deposits in the Manitouwadge camp. It must be noted, however, that anthophyllite, a major constituent in alteration zones in the Manitouwadge camp, has not yet been recognized at Swill Lake. Irregardless, the occurrence of such alteration, far removed from the "mine series" rocks, is encouraging and dramatically expands potential target areas in the camp.

Pyrite Occurrences North of Manitouwadge

Within migmatitic and gneissic rocks of the Quetico Subprovince, immediately north of the Manitouwadge synform and the Quetico–Wabigoon boundary, several pyrite occurrences have been investigated. They are apparently widely distributed in the area accessed by the Husak and Olson roads between Everest and Pearly lakes. The mineralization consists of fine-grained, disseminated to coarse-grained euhedral pyrite ± quartz in biotitic metasedimentary migmatite, regionally striking at 095°. Migmatitic tonalites and diorites, and pegmatite are intercalated with the metasediments, commonly developing a *lit-par-lit* structure. The mineralized zones, developing 15 to 30 cm wide gossans, are parallel to local schistosity and/or gneissosity and are persistent on an outcrop scale. Sampling of the pyritic zones returned the assays listed in Table 7.8.

Pukatawagan Lake Property

A claim block was staked by R. Renner in the vicinity of Pukatawagan and Roccian lakes, approximately 20 km north-northeast of Marathon. The area, despite being underlain by metavolcanic and metasedimentary rocks, has attracted limited exploration activity, most of which had been focussed on a nearby serpentinite body.

The metavolcanic succession consists primarily of foliated, massive mafic to intermediate flows and tuffs. Thin, cherty, felsic tuffaceous units and interflow sedimentary rocks make up a minor, but significant portion of the succession. Strikes of the bedded units are highly varied, suggesting that they may be folded on a local scale; no small-scale folds were noted, however.

The metavolcanic rocks are typically fine grained and locally feldspar-phyric. Fine-grained, disseminated pyrrhotite, pyrite and minor chalcopyrite occur in amounts up to 5 percent. Veinlet and stringer sulphides are much less common.

Interflow sedimentary and felsic tuffaceous units apparently range upwards from 10 m in thickness; contacts with the enclosing metavolcanic rocks are not exposed. The metasedimentary rocks consist of epiclastic turbidites, predominantly wackes and sedimentary breccias, and cherts and black mudstone. These units are fairly massive; bedding is usually indistinct. The breccias consist of angular cobble- to boulder-sized fragments of slump-bedded black chert, mudstone and wacke in a poorly sorted wacke matrix. One particular bed contains small tabular white chert fragments that show flow alignment. Pyrrhotite, pyrite, chalcopyrite and sphalerite occur within the breccia matrix. The sulphides may be laminated or locally massive.

Selected grab samples and their assays are presented in Table 7.9.

TABLE 7.8. ANALYTICAL RESULTS, HUSAK–OLSON ROADS AREA.

Sample Number	Cu (ppm)	Zn (ppm)	Pb (ppm)	Au (ppb)	Ag (ppm)
89BRG-01	530	26	--	nil	nil
89BRG-02	1285	143	--	nil	nil
89BRG-03	1700	211	< 10	27	< 2
89BRG-04	1500	315	< 10	11	< 2

TABLE 7.9. SELECTED GRAB SAMPLES FROM PUKATAWAGAN LAKE PROPERTY.

Sample Number	Cu (ppm)	Zn (ppm)	Au (oz./ton)	Ag (oz./ton)	Description
89BRR-01	440	840	< 0.01	< 0.10	feldspar-phyric intermediate metavolcanic
89BRR-04	133	1580	< 0.01	< 0.10	black mudstone
89BRR-06	1120	475	< 0.01	< 0.10	intermediate metavolcanic
89BRR-12	3090	99	trace	< 0.10	chloritic intermediate tuff
	(%)	(%)			
89BPL-01	0.030	0.001	0.037	trace	felsic tuff
89BPL-02	0.051	0.006	0.021	trace	felsic tuff
89BPL-05	0.010	0.305	0.009	nil	black mudstone
89BPL-06	0.042	0.069	0.005	trace	sulphide-rich wacke
89BPL-08	0.028	0.063	nil	trace	chert breccia
89BPL-14	0.437	0.009	trace	nil	chloritic intermediate tuff

Wullie Lake Property

Wullie Lake lies approximately 17 km north-northwest of Marathon. The Wullie Lake property consists of three patent claims held by the estate of D. Fairbairn. The sulphide occurrences were first staked in 1914 and patented in 1919. Small adits and pits were sunk at this time. Exploration activity by Anaconda Company (Canada) Limited and Lakehead Mines Limited in the area led to the acquisition and exploration of the property by Seemar Mines Limited in the early 1960s. The property has remained largely inactive since then.

The property lies along the north margin of the Late Precambrian Coldwell alkalic complex where it is in contact with Archean metavolcanic, metasedimentary and granitic rocks. The mineralized zones are hosted by what Wilkinson and Colvine (1978) termed heterogeneous gabbro, characterized by highly variable grain size and mineralogy, and miarolitic zones rich in hydrous minerals.

The main mineralized zone manifests itself as a 45 to 60 m wide gossan striking approximately 100°, which has reportedly been traced intermittently for over 1 km (unpublished report, Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). The gossan development hampers recognition of the host rocks and sulphides. Chalcopyrite-rich zones are commonly identified by the presence of malachite and azurite.

The mineralization consists of fine-grained, disseminated pyrrhotite and chalcopyrite and larger composite sulphide aggregates, 2 to 5 mm in size. Disseminated magnetite in amounts up to 10 percent is ubiquitous. There are lensoid zones of massive magnetite in which apatite is the dominant accessory mineral. Reported grab samples from 1965 sampling have returned values as high as 4.39 percent Cu, 2.76 percent Ni, 1.6 ounces Ag per ton and 0.05 ounce Au per ton. One diamond-drill section returned 0.19 percent Cu over 121.5 feet (unpublished report, Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). No PGE assays had been reported.

Assay results from the 1989 sampling are presented in Table 7.10.

Glacier Creek Occurrence (Potter Prospect)

The Glacier Creek or Potter prospect is located 40 km northeast of Nipigon and is accessible by the Little Bear Quarry road. The occurrence is situated along the Jackpine River–Glacier Creek fault, approximately 7 km east of Cosgrave Lake.

The exploration history dates back to the summer of 1955 when the property was staked by R. Kotanen, then optioned in 1956 to Frobisher Ltd. who conducted geological mapping and geophysical surveys. The property was acquired by R. Potter in 1957 and a 1444-foot drilling program was conducted, testing a strike length of approximately 1500 feet (Pye 1965). The drilling indicated a copper-bearing zone up to 50 feet wide, including a narrow section 3 to 14 feet wide, averaging over 1 percent Cu (Pye 1965). The property was later optioned to MacLeod–Cockshutt Gold Mines Ltd. who carried out a second program of diamond drilling.

The property is presently staked by D. Kukkee of Thunder Bay whose recent prospecting has identified additional copper occurrences and the presence of gold mineralization.

The area is underlain by granite gneiss and metasedimentary rocks, as well as later granitic stocks and dikes. The metasedimentary rocks include biotite-quartz-feldspar gneiss, garnet gneiss, hornblende schist and augen gneiss as identified by Pye (1965). The metasedimentary rocks identified by the authors were predominately biotite schists and biotite-quartz-feldspar gneiss and displayed strong foliation and evidence of folding, faulting and shearing. Granite and granitic migmatite envelope the metasedimentary xenoliths and remnants.

A major fault known as the Jackpine River–Glacier Creek fault transects the area and has a potential strike

TABLE 7.10. ASSAY RESULTS FROM WULLIE LAKE PROPERTY.

Sample Number	Sample Description	Cu (ppm)	Ni (ppm)	Pt (ppb)	Pd (ppb)	Au (ppb)
89BWU-01	gabbro, shoreline dump	3320	260	40	85	50
89BWU-02	leucogabbro, creek zone	2000	128	115	280	100
89BWU-03	pegmatitic leucogabbro, creek zone	1920	92	100	280	95
89BWU-04	gabbro, pit #1	1590	136	6	13	6
89BWU-05	gabbro, pit #2	1940	108	215	27	7
89BWU-06	gabbro, pit #3	1440	108	9	17	9
89BWU-07	Cu-rich float, pit #4	4070	178	12	24	15
89BWU-08	gabbro, pit #5	4750	212	22	45	20

(Note: All Ag assays < 3 ppm)

length of over 60 km. This fault is believed to be related to the Isle Royale fault or flexure and is developed in Proterozoic sedimentary rocks of the Sibley group on Vert Island in Nipigon Bay, and is therefore interpreted as being Proterozoic in age. At least five copper-silver ± gold occurrences are identified along a 20 km section of the fault.

Mineralization was observed over a 1000 m strike length predominantly in outcrops on the banks of Glacier Creek. Glacier Creek occupies a topographic lineament representative of the fault. Diamond drilling has identified widths of over 30 m of copper mineralization. The copper mineralization is predominantly hosted by quartz-carbonate veins and deformed and altered granitic rocks. The veins display a crack seal texture; however, brecciated and vuggy sections are common. Pyrite, chalcopyrite and bornite with malachite and azurite are common. Pink calcite is an accessory mineral within the veins. In several areas, narrow quartz stringers are confined to zones up to 15 m in width. These veins are generally parallel to the main fault which strikes 355° to 020°. The veins at one location strike 188/78W. Additional narrow veins appear slightly oblique to the main fault and possibly represent second order tensional veins. The veins are commonly hosted by a pink feldspar-rich granitic rock interpreted as representing a late granitic intrusion. The intrusion is commonly crosscut by pegmatitic dikes which may have remobilized and concentrated the sulphides.

At another location, a crack seal vein system has abundant chlorite slips and seams. The vein reaches a maximum width of 0.80 m. Vein breccia is common consisting of quartz-rich fragments and granitic fragments in a more mafic matrix.

Analytical results of collected samples indicated copper values up to 17.2 percent from selected grab samples and while gold values were generally low (nil to 0.01 ounce Au per ton), several values up to 0.05 ounce Au per ton were returned from several locations. Analyses by D. Kukkee indicate gold values up to 0.13 ounce Au per ton. Samples from other properties along this fault zone have yielded gold values in excess of 0.33 ounce Au per ton (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

Power Creek Occurrence

The Power Creek occurrence lies approximately 500 m east-southeast of the shaft and trenched area of the McKenna-McCann property, 3.2 km northeast of Schreiber. The property is currently held by W. Acker and R. Otto of Schreiber. Exploration and development work on auriferous quartz veins was carried out locally in the 1930s and some of the old pits and trenches are still evident. However, no extensive work had apparently been undertaken on the Power Creek occurrence which was discovered and investigated in the fall of 1989.

The host rocks consist mainly of carbonatized, locally pillowed mafic flows which are foliated at 230/40N. Chert, sedimentary chert breccia and iron formation are intercalated with the metavolcanic rocks. Bedding orientations are locally varied suggesting that units have been folded. A conjugate set of faults striking at 25° and 135°, respectively, has influenced the development of minor structures, auriferous quartz veins and local topography.

A banded jasper-magnetite iron formation is exposed in the bed of a small creek, locally called Power Creek, which flows into Big Duck Creek. This is perhaps the first discovery of well-developed banded jaspilitic iron formation in the Schreiber-Hemlo District. Minor jasper has been identified near the Schreiber-Pyramid mine site. Locally, jasper is notably absent in virtually all oxide- and sulphide-facies iron formations. The unit is thinly bedded; some beds are contorted and/or brecciated.

This iron formation hosts a number of subparallel, anastomosing quartz-carbonate veins and vein breccias which strike at approximately 215°, roughly at right angles to the creek bed. Extensive rusty carbonatization is associated with the vein breccias. Sparry calcite, epi-

TABLE 7.11. ASSAY RESULTS OF SELECTED GRAB SAMPLES OF THE POWER CREEK OCCURRENCE.

Sample Number	Au (oz./ton)	Ag (oz./ton)	Description
89BPC-02	0.021	nil	quartz-carbonate vein, drusy tourmaline, ≤1% pyrite
89BPC-04	0.066	trace	jasper-magnetite BIF, veinlet and euhedral, disseminated pyrite ≤2%
89BPC-06	0.013	nil	wacke(?). Carbonatized, green mica, amphibole-rich, minor pyrite on joint surfaces
89BPC-07	0.015	nil	quartz-brecciated BIF, veinlet and disseminated pyrite ≤2%

TABLE 7.12. GEOCHEMISTRY, WEST DEAD HORSE CREEK SUBCOMPLEX.

	Western Zone	Eastern Zone
beryllium	up to 0.62 wt%	up to 240 ppm
scandium	up to 250 ppm	up to 85 ppm
zirconium	up to 11.6 wt%	up to 2.8 wt%
thorium	up to 0.52 wt%	up to 0.15 wt%
uranium	up to 0.31 wt%	up to 0.08 wt%
REEs	up to 1250 ppm	up to 1220 ppm
yttrium		up to 235 ppm
mineralogy	zircon, Ca-Zr-silicates thorite, phenacite	monazite, riebeckite xenotime (high P_2O_5 (up to 2.46 wt%))
La/LuN	0.09 (heavy REE-enriched)	9.1 to 17.6 (light REE-enriched)

dote and drusy tourmaline occur as accessory minerals in the massive to ribbon-textured quartz veins. Fine- to coarse-grained euhedral pyrite occurs in the iron formation proximal and adjacent to the veins. There is some preferential replacement of the magnetite by pyrite. Other sulphides have not yet been recognized.

Assay results of selected grab samples of the host rocks and veins are shown in Table 7.11.

RESEARCH BY SCHREIBER-HEMLO RESIDENT GEOLOGIST'S STAFF

Rare Earth Element Study

Following sampling of the west Dead Horse Creek diatreme-hosted REE occurrence in 1988 and initial study (Schnieders and Smyk 1989), petrographic studies were carried out in 1989 in conjunction with R.P. Taylor, Carleton University and D.L. Kingston, University of Western Ontario. The nature and distribution of the REE-bearing minerals were investigated using microscope and electron microprobe techniques.

Although the mineralized zones are all enriched in zirconium, thorium, uranium and REEs, local variations exist in geochemistry and mineralogy as shown in Table 7.12.

Ongoing study will attempt to resolve the apparent dichotomy of the mineralization patterns and suggest a genetic model that will be useful to the exploration industry.

HISTORICAL RESEARCH

Historical research of old newspapers by K.G. Fenwick continues to add valuable information, photos and locations of mineral occurrences and deposits throughout the Schreiber-Hemlo District. The Terrace Bay-Jackfish area was particularly active during the 1930s exemplified by this *Daily Times-Journal* report:

> "EMPRESS DRILLING CUTS 100-FT. VEIN
>
> In a telegram to the Times-Journal from Jackfish this afternoon, officials of Empress Gold mines announce that diamond drill results are beyond expectations and to date check favorably with previous surface and lower adit assays."
>
> The telegram states:
>
> "Diamond drill hole number one on Empress Consolidated cut the main vein about 100 feet east of the lower adit, at a vertical depth of 120 feet, with indicated width of 100 feet averaging $6.10 (0.174 ounce Au per ton) over this width.
>
> Drill hole number two, started 100 feet east of number one, is down 90 feet and should be completed by Thursday."
>
> (Monday, September 28, 1936, p.10)

RECOMMENDATIONS FOR EXPLORATION

GOLD

Hemlo-Heron Bay-Manitouwadge Area

The metavolcanic and metasedimentary rocks which wrap around the Heron Bay, Gowan Lake and Cedar Lake plutons are considered to have excellent potential for gold. Metavolcanic-metasedimentary contacts, deformation zones and flexures in these zones and porphyry contacts, together with the presence of sericite schists, disseminated pyrite, molybdenite, green mica, barite and pervasive potassic alteration (microcline and muscovite-sericite) are considered to be important in characterizing gold mineralization in the Hemlo area.

Recent developments and exploration in the Hemlo camp have indicated parallel mineralized zones within both the footwall and hanging wall rocks. Further exploration, including stripping, trenching and sampling, is warranted along the barite-green mica-sericite-pyrite horizons to the west and east of the Hemlo mines.

In the Hemlo area, the gold deposits are also hosted by sericite-muscovite-pyrite schists in amphibolite facies rocks. Therefore, an area such as Manitouwadge which is recognized solely for base metals, but has numerous sericite-muscovite schists units, should be reinvestigated for gold potential possibilities.

In the Manitouwadge area (Mapledoram-Gemmell townships), a quartz-feldspar porphyry and/or feldspar porphyry (unit 13b) is identified on Map 2280 (Milne 1974), located south of the Geco Mine and is recommended as a prospecting target for gold and base metals.

The Cirrus Lake–Goodchild Lake–Veronica Lake area (Milne 1967) requires further exploration. During 1988, several high-grade molybdenite-bearing quartz veins containing low gold values (0.01 to 0.03 ounce Au per ton) were discovered by R. Renner in the Pic River area. Investigations in 1989 by the authors on an unnamed lake, 3 km southwest of Goodchild Lake and 3 km south of Roccian Lake, indicated numerous quartz veins and gossan zones. Analytical values up to 0.004 ounce Au per ton were identified in reconnaissance sampling. Further prospecting in this area is warranted.

Reanalysis of lake bottom sediment samples from a 1970s survey by the Geological Survey of Canada was performed as part of an orientation study to evaluate lake sediments for precious metals content. Samples from three lakes to the west and south of Goodchild Lake, namely Fallen Lake, Budall Lake and a small lake approximately 1.6 km (1 mile) east of Budall Lake, indicate anomalous gold values. An association of gold, chromium and nickel, and to a lesser extent zinc, silver and cadmium is apparent (P. Friske, Geological Survey of Canada, personal communication, 1987). Felsic intrusive rocks in the Veronica Lake area and west of Goodchild Lake are recommended targets.

Schreiber–Terrace Bay Area

The northwest contact aureole at the Terrace Bay batholith is considered an excellent gold exploration target. The exploration model presented in Patterson et al. (1987) suggests one possible approach to this area. Felsic intrusive rocks, including porphyry and aplite dikes, are abundant adjacent to the Terrace Bay batholith and display potassic alteration with elevated gold levels. Preliminary sampling of an aplite dike on the Hays Lake property indicated 0.05 ounce Au per ton. Exploration models presented in Patterson et al. (1987), combined with "Recommendations for Exploration", helped in the discovery of a new gold occurrence by prospectors M. Joa and R. Walton. In 1989, several new veins and a copper-rich porphyry zone were discovered. Further prospecting and exploration are recommended in the North Shore–Harkness Hays–Gold Range–Hays Lake area due to the abundance of high-grade gold-bearing quartz veins. Gold mineralization associated with banded jaspilitic iron formation north of Hays Lake is also a recommended target (*see* Power Creek Occurrence).

Exploration programs on narrow, high-grade, structurally controlled veins, such as the Johnston–McKenna, McKenna–McCann and Schreiber–Pyramid properties, should make use of the prospectors' tool of the 1980s, the backhoe, and include two-dimensional stripping and trenching. Small-scale mining operations could consider optical sorting methods for these vein types.

The Big Duck porphyry and its contacts with the surrounding metavolcanic rocks have a high potential with more than 20 known gold occurrences present in a 6 by 3 km area. Structural controls combined with potassic alteration and disseminated sulphide mineralization are suggested as indicators of gold mineralization.

Previous prospecting and exploration in the Barbara Lake–Glacier Creek area have indicated a large-scale, north-northeast-trending fault system (Jackpine River–Glacier Creek fault) with scattered copper occurrences along a 20 km strike length. Previous diamond drilling has indicated widths of over 30 m assaying 0.5 percent Cu. Recent prospecting and sampling have indicated gold values up to 0.33 ounce Au per ton (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). Further prospecting and exploration is recommended in the Glacier Creek–Kabamichigama Lake area along these large-scale fault systems.

The historical research data and files compiled by K.G. Fenwick and periodically incorporated into the Schreiber–Hemlo District mineral deposit files are excellent sources of information, often including locations and descriptions of previously discovered occurrences. Often these occurrences have been forgotten over time. Therefore, this historical data is highly recommended as a tool for the prospector and explorationist.

BASE METALS

Winston Lake Area

Calc-alkalic intermediate to felsic metavolcanic rocks in this area are considered to have a high exploration potential for base metals. The metavolcanic rocks consist of pyroclastic flows, debris flows and laminated ash deposits. Intense hydrothermal alteration of these and associated calc-alkalic metavolcanic rocks has been responsible for the misidentification of such indicator rocks. In addition, the nature of the sheet-like boudinaged base metal deposits in the Winston Lake area, and of the rafted and dislocated mineralized zones at the Zenith deposit, is a testament to the complex structural deformation.

Lithogeochemical surveys to detect sodium and calcium depletion, and magnesium, potassium, zinc and copper enrichment, are considered valuable exploration tools for identifying hydrothermal alteration zones associated with massive sulphide base metal deposits.

Lyne Lake–Victoria Lake Area (Northern Killraine and Priske Townships)

The authors consider the Lyne Lake–Victoria Lake metavolcanic-metasedimentary rocks to represent an extension of the Winston Lake stratigraphy which has been separated by granitic intrusions. Calc-alkalic, felsic to intermediate, fragmental metavolcanic rocks are considered excellent exploration targets, as are areas of metamorphosed hydrothermal alteration characterized by cordierite, anthophyllite, sillimanite and garnet.

Santoy Lake–McKellar Lake Area (Tuuri and Walsh Townships)

This area is underlain by a large felsic metavolcanic unit which trends west-northwest and hosts numerous base metal occurrences including the Marlhill, Goldbar Lake, Bozena (Bonne), Prairie West, Alvey and Granite Mountain properties. Felsic pyroclastic flows and tuffs were observed in the Granite Mountain area where clast-supported flows contained considerable garnet in the matrix. Copper, zinc and magnesium enrichment, combined with sodium depletion, were noted in deformed metavolcanic rocks in the Marlhill area. Recent diamond drilling by Noranda Exploration Company, Limited, and Cumberland Resources Ltd. has intersected encouraging base metal values. Felsic metavolcanic rocks in the Fishnet Lake area have been mapped as "andalusite-bearing tuffs" by Walker (1967) and may represent hydrothermally altered rocks. Iron formation and related chemical and clastic metasedimentary rocks commonly contain anomalous zinc, lead, copper, silver and gold concentrations and should be explored.

Pic River Area (Page Lake–O'Neill Township)

The economic potential for gold and base metals is considered high in the felsic metavolcanic rocks of the area, and at contacts of these rocks with the mafic metavolcanic and metasedimentary rocks in the Page Lake area, located 15 km northeast of Marathon and 6 km east of Bamoos Lake. Patterson (1984) described the Knut Kuhner occurrence:

> "The geology of the property was mapped by Milne (1967). It is underlain by felsic pyroclastic rocks on the west and mafic metavolcanics on the east. Metasediments, graphitic schists, pelites, cherts, and massive sulphides occur between the felsic and mafic metavolcanics. A lake bottom sediment geochemistry sampling program (Geological Survey of Canada, Open File Report 746) shows a large copper, lead, zinc and mercury anomaly, similar to the anomaly at Manitouwadge, centred on Page Lake.
>
> In 1983, drill logs with complete assays, from an exploration program by Kerr Addison Mines Ltd. in 1971, were added to the Resident Geologist's Files; Ontario Ministry of Northern Development and Mines, Thunder Bay. The best results were for drillhole KP-71-5 which intersected 18.2 feet of 0.08 ounce gold per ton and 1.16 percent zinc.
>
> The mineralization occurs as pyrrhotite, sphalerite, and pyrite hosted in felsic metavolcanics.
>
> Airborne geophysics done by Shell Canada Resources Ltd. in 1977 shows a number of EM conductors (Resident Geologist's Files; Ontario Ministry of Northern Development and Mines, Thunder Bay)."

Reconnaissance investigations in the Page Lake area in 1989 identified sulphide gossans on the north shore of a small lake situated approximately 750 m west of the north end of Page Lake. Further prospecting and sampling is warranted in this area.

In the Louis Lake area, approximately 4 km northwest of Goodchild Lake, sampling by the authors indicated sulphide horizons with values up to 0.006 ounce Au per ton, 0.28 ounce Ag per ton, 0.13 percent Cu and 0.08 percent Zn. While initial assay values are low, further prospecting is warranted.

Manitouwadge Area

The limbs of the Manitouwadge synform and the extensions of the Manitouwadge stratigraphy into Gemmell, Nickle and Herbert townships, as well as to the north of those townships, are considered high potential areas for base metals. Preliminary reconnaissance during 1988 and 1989 identified areas of metasedimentary and metavolcanic gneisses, or "ghost greenstone", previously denoted as granitic rocks on the compilation map in the Manitouwadge area. The metavolcanic-metasedimentary limbs have been extremely disrupted and intensely deformed, and subjected to amphibolite grade metamorphism and hydrothermal alteration. Consequently, these rocks can be obscured and are difficult to identify as exploration targets.

In addition, the mineralized showings are generally considered "dry" looking and are not very spectacular. However, caution and a fair amount of patience must be taken when assessing showings in amphibolite facies terranes, as the discovery of Manitouwadge and Hemlo mining camps has proven.

The presence of sillimanite, cordierite, garnet and anthophyllite (gedrite) is indicative of hydrothermal alteration and/or high-grade metamorphism. Most known ore deposits are hosted by muscovite-quartz schist. Gedrite was discovered on the north limb of the Manitouwadge synform near Rabbitskin Lake in 1988.

In the vicinity of Michal and Fakeloo lakes, approximately 30 km northwest of Manitouwadge, Coates (1968, 1970) has mapped metavolcanic and metasedimentary migmatites. The east-trending contact zone may broadly represent the boundary between the Quetico and Wawa subprovinces. Exploration in the mid-1960s detected geophysical anomalies, some of which were ascribed to sulphide occurrences containing pyrite, pyrrhotite, graphite, minor chalcopyrite and molybdenite in metasedimentary gneisses (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay). Further work is suggested to delineate relict metavolcanic rocks which may represent isolated inliers of the mine series stratigraphy in the Manitouwadge area. All sulphide occurrences should be investigated for their base metal and gold potential.

During the course of reconnaissance mapping in the Quetico Subprovince, Williams (1988) discovered anthophyllite- and garnet-rich rusty quartzites and mafic gneisses. The presence of anthophyllite was confirmed by X-ray diffraction and refractive index analyses (H.R. Williams, Ontario Geological Survey, personal communication, 1989). The garnet and anthophyllite occur in several different rock types which are exposed on the Florrie Lake road, 5 km northeast of its junction with the Wintering road, approximately 70 km north of Terrace Bay and 7.5 km north of Chorus Lake.

The occurrence of hitherto unknown anthophyllite in this area is intriguing and should be investigated further. Anthophyllite and garnet are integral constituents of the amphibolite facies grade hydrothermal alteration assemblages in the Winston Lake and Manitouwadge mining camps.

PLATINUM GROUP ELEMENTS

Exploration for PGE mineralization in the Schreiber-Hemlo area could be concentrated in seven major areas: 1) the Coldwell alkalic complex, 2) the Killala Lake alkalic complex, 3) the Goodchild Lake area, 4) the Rhea Lake-Hornblende Lake area, located 13 km northwest of Schreiber, 5) the Jackfish area, 6) the Shabotik Township area, and 7) 15 km southeast of Manitouwadge in the Emerald Lake-Faries Lake area.

Prospecting and exploration for PGE in the Schreiber-Hemlo District should concentrate on the following parameters or characteristics:

1. mafic to ultramafic (dark-coloured) intrusive rocks of Proterozoic to Archean age
2. disseminated sulphide mineralization within the mafic to ultramafic intrusive rocks—generally less than 5 percent is sufficient—(copper-rich sulphide concentrations are enriched in PGE in several areas within the Coldwell alkalic complex and elsewhere)
3. mafic or ultramafic rocks, which display variations in grain size (i.e., fine grained to pegmatitic), modal layering, disrupted layering, intermixing of magma types, magmatic-related breccias, and pegmatitic dikes or veins

Any areas which exhibit the above characteristics, especially those of 3. (listed above), should be thoroughly prospected and sampled for PGE.

The Coldwell and Killala Lake alkalic complexes are currently being explored for PGE. Cursory studies of copper sulphide-type PGE mineralization have cited characteristic parameters that may aid exploration. Copper- and PGE-rich sulphide concentrations locally occur in gabbroic rocks (Patterson et al. 1987; Coates 1970). The gabbroic rocks commonly display evidence of magma mixing, alteration and multiple intrusive events. Sulphides, occurring in breccias, dikes, pegmatites, veins and altered portions of the gabbro, should be sampled and assayed for PGE. The rocks in the Goodchild Lake, Rhea Lake-Hornblende Lake and Jackfish areas are Archean metavolcanic rocks and mafic to ultramafic intrusive rocks with which copper-nickel sulphides are associated. It is suggested that PGE mineralization may be associated with these copper-nickel sulphides.

In the Goodchild Lake area, sulphides occur in an altered metavolcanic body (Milne 1967). The Nicopor Mines copper-nickel occurrence is situated in amphibolitized metavolcanic rocks and gabbros, along a contact with a granite, in the Rhea Lake area (Bartley 1939). Gabbro, diorite, hornblendite and derived amphibolite occur within a metavolcanic belt in the Jackfish area (Walker 1967). There have been references about a platinum discovery made near the turn of the century by a Captain Pritchard (Schnieders et al. 1988).

With the recent discovery of PGE in the Shabotik Township area, further prospecting and exploration is warranted in this region. The Kwinkwaga Lake Map 2179G (ODM-GSC 1963) displays high magnetic anomalies in the southeastern and northwestern corners of Shabotik Township as well as central Mikano Township, northern Flood Township, northeastern Bryant and central Hambleton townships, which should all be investigated. The high magnetic anomalies normally indicate the presence of mafic rocks, such as diabase, gabbro or serpentinite, which have a relatively high iron content and in special instances, may be due to concentrations of magnetic minerals such as pyrrhotite and magnetite. Soil and rock geochemical surveys, combined with geophysical surveys (IP and Mag), can be effective exploration tools.

Reconnaissance mapping of the area southeast of Manitouwadge by H. Williams and F. Breaks in 1989 has identified a layered mafic intrusive suite within tonalite. Layered complexes consisting of peridotite, gabbro and anorthosite occur in the Emerald Lake-Faries Lake and Moshkinabi Lake areas. Rocks containing sulphides, especially those displaying variations in grain size, layering or brecciation, should be investigated for their copper-nickel and PGE potential. The most extensive exploration program to date was conducted by Falconbridge Nickel Mines Ltd. in the 1960s. Anomalous platinum and palladium values, up to 75 and 300 ppb, respectively, have been obtained from recent sampling (Resident Geologist's Files, Ministry of Northern Development and Mines, Thunder Bay).

RARE EARTH ELEMENTS

Exploration for REE should concentrate on 1) syenitic dikes, and 2) diatreme structures, in and around the Coldwell alkalic complex. Potential targets are invariably radioactive and are most easily discerned using a portable scintillometer or Geiger counter. Pervasive hematitization and silicification are associated with diatreme-hosted mineralization. Calcite and epidote are common accessory minerals.

INDUSTRIAL MINERALS

Exploration for industrial minerals appears to be on an upswing. High-quality amethyst is available on an, as yet, undeveloped property on Nagunagisic Lake just north of Wiggins Township. Exploration for building stone has concentrated on syenites in the Coldwell alkalic complex ("black" and "red granite") and on buff to red sandstone on the offshore islands in Lake Superior, between Red Rock and Rossport. Lithium- and beryllium-bearing pegmatites are present in the Georgia and Barbara lakes area. A more complete description of Industrial Minerals and REEs in the Schreiber-Hemlo District is available in Gerow and Bellinger (this volume).

DRILL CORE STORAGE PROGRAM

Officially opened in 1986, the Thunder Bay Drill Core Library is one of seven such libraries across the province operating as part of the Ontario Drill Core Storage Program. Each drill core library collects, stores, catalogues

TABLE 7.13. DIAMOND-DRILL CORE COLLECTED, 1989, SCHREIBER–HEMLO DISTRICT.

	Company/ Individual	Property/ Location	Year Drilled	Number of Holes	Metres of Core Stored
1)	Ansell Lake Resources Limited Lake	Ansell Lake Lower Aguasabon	1989	2	273
+2)	Belmoral Mines Ltd.	Marathon Walsh Township	1989	5	5.5

+ Core specimens submitted for assessment credit, as per Section 76(6) of the Ontario Mining Act.

and preserves drill core and associated data, mainly from Ontario's mineral exploration and mining industry. All drill core is eventually made available to the public for examination.

The Thunder Bay Drill Core Library collects drill core from the Thunder Bay Mining Division, which encompasses three Resident Geologist's districts: Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo.

If you would like to examine or donate drill core from the Thunder Bay Mining Division or if you have any questions about the Thunder Bay Drill Core Storage Program, please phone (807) 475-1331 or fax (807) 475-5312 or write to:

Thunder Bay Drill Core Library
Ministry of Northern Development and Mines
435 James Street South
Thunder Bay, Ontario P7C 5G6

As of November 30, 1989, 98825 m of drill core is stored at the Thunder Bay Drill Core Library. Some of this material is still under a period of confidentiality. Drill core available for public examination includes 26 950 m from 36 properties in the Schreiber–Hemlo Resident Geologist's District.

In 1989, 280 m of drill core from two properties were collected, stored and catalogued at the Thunder Bay Drill Core Library as listed in Table 7.13.

In addition, 5601 m of drill core from seven drill holes have been released from a period of confidentiality. All the drill core is from a major exploration program by Gold Fields Canadian Mining Ltd. in the Hemlo area.

Gold Fields Canadian Mining Ltd., Hemlo Area

In 1985 and 1986, Gold Fields Canadian Mining Ltd. conducted a major diamond drilling program in Lecours and Pic townships, approximately 8 km west, and structurally along strike, of the Hemlo gold deposits. During this period, the company completed about 18000 m of drilling in nine separate properties that it held in joint venture with various other companies. The depth of the holes range from 105 to 1110 m; the bearing of all holes are either due north or due south and dip at angles ranging from 45° to 75°.

Gold Fields Canadian Mining Ltd. donated all drill core, along with the accompanying drill logs, to the Thunder Bay Drill Core Library.

The drill logs indicate that all drill holes intersect a complex intercalation of mafic metavolcanic and intrusive rocks, felsic to intermediate tuffaceous rocks, clastic and chemical metasedimentary rocks, ultramafic intrusive rocks and felsic intrusive rocks. The drill core sections contain fault breccia zones, shear zones and mylonites. Silica, carbonate, graphite, hematite and epidote are some of the alteration types observed. Quartz-carbonate, quartz-feldspar and quartz-tourmaline veins are present. Mineralization includes minor disseminated pyrite and very minor pyrrhotite and chalcopyrite. Many of the lithologic units are observed to be magnetic. The rocks preserve a moderate to high grade of metamorphism with garnet, calc-silicates, epidote, amphibole and coarse-grained biotite observed in drill core.

Generally, the drill logs indicate that drill holes in the northern parts of the properties intersect a package of predominately felsic to intermediate tuffs and clastic metasedimentary rocks; however, the northernmost parts of these drill holes are dominated by mafic metavolcanic and intrusive rocks. Drill holes in the southern parts of the properties intersect mafic metavolcanic flow and tuffaceous rocks with subordinate felsic to intermediate tuffs, clastic metasedimentary rocks, cherts, iron formations and ultramafic intrusive rocks. All lithologies appear to be intruded by felsic intrusive rocks.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

1. T.L. Muir completed the field work for the tectono-stratigraphic study of the Hemlo area. Much of the field season was devoted to filling in holes in the previous seasons' mapping and documenting and mapping recently exposed outcrops associated with surface mine development.
2. H.R. Williams and F.W. Breaks have begun reconnaissance geological mapping in the Manitouwadge area as part of their studies in the Manitouwadge–Hornepayne area. The project involves lithostructural mapping in order to trace out extensions of the supracrustal rocks and identify other lithologic units with possible economic potential. This infor-

mation will help in increasing the effectiveness of mineral exploration in this base metal camp.

RESEARCH BY OTHER AGENCIES

T. Barrett (IREM-MERI, McGill University), P. Fralick (Lakehead University) and I. Jarvis (Kingston Polytechnical Institute, UK) are conducting rare earth and trace element analyses on barite horizons and associated rocks from the Hemlo area.

T. Barrett (IREM-MERI, McGill University), P. Fralick (Lakehead University) and B.R. Schnieders (Mines and Minerals Division, Ministry of Northern Development and Mines, Thunder Bay) are studying the morphology and geochemistry of colloform structures in sulphide-facies iron formation on the Morley property, Schreiber.

P. Fralick (Lakehead University) and H. Strauss (Ruhr Universitat, West Germany) are investigating sulphur and carbon isotope values from the Winston Lake massive sulphide deposit, and sulphide-facies iron formation in the Schreiber–Terrace Bay area.

R.H. Mitchell and R.G. Platt (Lakehead University) are continuing research into the petrology of the Coldwell alkalic complex.

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

Y. Pan (MSc candidate, University of Western Ontario, London) in conjunction with M.E. Fleet (Professor, University of Western Ontario, London) is continuing a metamorphic petrology study of the White River gold prospect.

D. Good (PhD candidate, McMaster University, Hamilton) in conjunction with J.H. Crocket (Professor, McMaster University, Hamilton) is investigating PGE occurrences in the Coldwell alkalic complex.

UNIVERSITY THESES

S. Osterberg (PhD candidate, University of Minnesota–Duluth) is conducting a stratigraphic-alteration study of the Winston Lake stratigraphy, Schreiber, Ontario.

Dave Nicol (MSc candidate, Lakehead University, Thunder Bay) is studying the structure of gneisses in the Faries Lake area near Manitouwadge.

Derek Nicol (MSc candidate, Lakehead University, Thunder Bay) is conducting a study on assimilation in Center 3 syenites of the Coldwell alkalic complex.

R. McLoughlin (MSc candidate, Lakehead University, Thunder Bay) is studying the rare element mineralogy of Center 3 syenites, Coldwell alkalic complex.

C. Barr (HBSc candidate, Lakehead University, Thunder Bay) is continuing his study of sphalerite geobarometry at the Winston Lake Division Mine (Minnova Inc.).

T. Mulja (MSc, Lakehead University, Thunder Bay) completed his study on the petrology and PGE mineralization of the Geordie Lake gabbro, Coldwell alkalic complex.

R. Vande Kemp (HBSc, Lakehead University, Thunder Bay) completed his study of the morphology and geochemistry of an Algoma-type, sulphide-facies iron formation near Schreiber.

M. Antonellini (PhD candidate, Michigan State University, East Lansing) is investigating tectonism associated with Logan diabase sill emplacement in Sibley group sedimentary rocks.

J. Grant (MSc candidate, Queen's University, Kingston) is conducting a tectono-stratigraphic field study in the Hemlo area.

SELECTED PUBLICATIONS RECEIVED

Good, D.J. and Crocket, J.H. 1989. PGE study of the Geordie Lake and Marathon Cu-Ni-precious metal deposits, Coldwell alkalic complex; *in* Geoscience Research Grant Program, Summary of Research 1988–1989, Ontario Geological Survey, Miscellaneous Paper 143, p.186-198.

Harris, D.C. 1989. The mineralogy and geochemistry of the Hemlo gold deposit, Ontario; Geological Survey of Canada, Economic Geology Report 38, 88p.

Pan, Y. and Fleet, M.E. 1989. Metamorphic petrology and gold mineralization of the White River gold prospect, Hemlo area; *in* Geoscience Research Grant Program, Summary of Research 1988–1989, Ontario Geological Survey, Miscellaneous Paper 143, p.42-52.

Williams, H.R. 1989. Geological studies in the Wabigoon, Quetico and Abitibi–Wawa subprovinces, Superior Province of Ontario, with emphasis on the structural development of the Beardmore–Geraldton belt; Ontario Geological Survey, Open File Report 5724, 189p.

REFERENCES

Bartley, M.W. 1939. The northwestern part of the Schreiber area; Ontario Department of Mines, Annual Report, 1938, v.47, pt.9, p.25-45.

Bartley, M.W. and Page, T.W. 1958. A geological report on the Hemlo area; Western Miner and Oil Review, v.31, no.8, p.29-34.

Coates, M.E. 1968. Geology of the Stevens–Kagiano lakes area, District of Thunder Bay; Ontario Department of Mines, Geological Report 68, 22p.

——1970. Geology of the Killala–Vein lakes area, District of Thunder Bay; Ontario Department of Mines, Geological Report 81, 35p.

Friesen, R.G., Pierce, G.A. and Weeks, R.M. 1982. Geology of the Geco base metal deposit; Geological Association of Canada, Special Paper 25, p.343-363.

Hugon, H. 1984. The Hemlo deposit: gold mineralization within a dextral shear zone; *in* Summary of Field Work 1984, Ontario Geological Survey, Miscellaneous Paper 119, p.212-216.

——1986. The Hemlo gold deposit, Ontario, Canada: a central portion of a large scale, wide zone of heterogeneous ductile shear; *in* Proceedings of Gold '86, an International Symposium on the Geology of Gold: Toronto, 1986, p.379-387.

Marmont, S. 1984. The Terrace Bay batholith and associated mineralization; Ontario Geological Survey, Open File Report 5514, 95p.

Milne, V.G. 1967. Geology of Cirrus Lake–Bamoos Lake area, District of Thunder Bay; Ontario Department of Mines, Geological Report 43, 61p.

——1974. Mapledoram–Gemmell, Thunder Bay District; Ontario Division of Mines, Map 2280, scale 1:12000.

Muir, T.L. 1982a. Geology of the Hemlo area, District of Thunder Bay; Ontario Geological Survey, Report 217, 65p.

——1982b. Geology of the Heron Bay area, District of Thunder Bay; Ontario Geological Survey, Report 218, 89p.

Muir, T.L. and Elliott, C.G. 1987. Hemlo tectono-stratigraphic study, District of Thunder Bay; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.117-129.

Mulja, T. 1989. Petrology, geochemistry, sulphide and platinum-group element mineralization of the Geordie Lake intrusion, Coldwell complex, Ontario; unpublished MSc thesis, Lakehead University, Thunder Bay, 234p.

Ontario Department of Mines–Geological Survey of Canada 1963. Airborne magnetic survey, Kwinkwaga Lake, Thunder Bay District; Ontario Department of Mines, Map 2179G, scale 1:50 000.

Page, T.W. 1947. A report on the Ollmann–Williams group of claims, Hemlo, Ontario; unpublished report, Resident Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay, 4p.

Patterson, G.C. 1984. Field trip guidebook to the Hemlo area; Ontario Geological Survey, Miscellaneous Paper 118, 33p.

Patterson, G.C., Scott, J.F., Mason, J.K., Schnieders, B.R., MacTavish, A.D., Dutka, R.J.A., Kennedy, M.C., White, G.D. and Hinz, P. 1987. Thunder Bay Resident Geologist's area, North Central Region; *in* Report of Activities 1986, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 134, p.72-127.

Pye, E.G. 1960. Geology of the Manitouwadge area; Ontario Department of Mines, Annual Report, 1957, v.66, pt.8, 114p.

——1965. Geology and lithium deposits of the Georgia Lake area, District of Thunder Bay; Ontario Department of Mines, Geological Report 31, 113p.

Schnieders, B.R. 1987. Geology of sulphide-facies iron formation and associated rocks in the lower Steel River–Little Steel Lake area, Terrace Bay, Ontario; unpublished MSc thesis, Lakehead University, Thunder Bay, 196p.

Schnieders, B.R. and Smyk, M.C. 1989. Schreiber–Hemlo Resident Geologist's District—1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.133-155.

Schnieders, B.R., Smyk, M.C. and White, G.D. 1988. Schreiber–Hemlo Resident Geologist's area—1987; *in* Report of Activities 1987, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 138, p.135-159.

Severin, P.W.A. and Balint, F. 1985. Geological setting of the Winston Lake massive sulphide deposit; *in* Gold and Copper-Zinc Metallogeny Within Metamorphosed Greenstone Terrain, Hemlo-Manitouwadge–Winston Lake, Ontario, Canada, Geological Association of Canada-Canadian Institute of Mining and Metallurgy, p.6-15.

Walker, J.W.R. 1967. Geology of the Jackfish–Middleton area, District of Thunder Bay; Ontario Department of Mines, Geological Report 50, 41p.

Wilkinson, S. and Colvine, A.C. 1978. Sulphide mineralization in the marginal phases of the Coldwell alkalic complex; *in* Summary of Field Work 1978, Ontario Geological Survey, Miscellaneous Paper 82, p.210-215.

Williams, H.R. 1986. Structural studies in the Beardmore–Geraldton belt, northern Ontario; *in* Geoscience Research Grant Program, Summary of Research 1985-86, Ontario Geological Survey, Miscellaneous Paper 130, p.138-146.

——1987. Structural studies in the Beardmore–Geraldton belt and in the Quetico and Wawa subprovinces; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.90-92.

——1988. Geological studies in the Wawa, Quetico and Wabigoon subprovinces, with emphasis on structure and tectonic development; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.169-173.

——1989. Geological studies in the Wabigoon, Quetico and Abitibi-Wawa subprovinces, Superior Province of Ontario, with emphasis on the structural development of the Beardmore–Geraldton belt; Ontario Geological Survey, Open File Report 5724, 189p.

8. Northwestern Region Industrial Minerals Program—1989

M.C. Gerow[1] and J.A. Bellinger[2]

[1]Industrial Minerals Geologist, Northwestern Region.

[2]Assistant Industrial Minerals Geologist, Northwestern Region.

INTRODUCTION

Production from northwestern Ontario's fourth granite dimension stone quarry commenced in 1989. The Forgotten Lake quarry, located north of Kenora, yields yellow granite. Pink granite continued to be produced from two quarries near Vermilion Bay and grey granite was quarried near Ignace. Mining of several amethyst deposits near Thunder Bay continued on a seasonal basis. White quartz, diabase and a small quantity of soapstone were also produced. Significant exploration continued for granite dimension stone and amethyst. Exploratory work was also carried out on potential deposits of silica, lithium, marl, quartz and graphite. Two companies received grants from the Northern Ontario Heritage Fund Corporation (NORFUND) for granite dimension stone evaluation programs.

The Industrial Minerals program is in its fourth year of operation. The goal of the program is to stimulate exploration, development and production of industrial minerals in northwestern Ontario, in accordance with a province-wide strategy of stimulating development of Ontario's industrial mineral resources and related manufacturing industries.

The Northwestern Region includes the Resident Geologists' districts of Kenora, Red Lake, Sioux Lookout, Thunder Bay, Beardmore–Geraldton and Schreiber–Hemlo.

Special projects undertaken this year include a study of soapstone in Ontario and a stone study for the Ignace area.

The program is jointly funded by the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario; and the Northwestern Region, Mines and Minerals Division, Ontario Ministry of Northern Development and Mines.

ACKNOWLEDGMENTS

D. Conrod of the Mineral Development and Lands Branch, Mines and Minerals Division, wrote the "Springpole Lake Fluorite-bearing Carbonatite" property visit. K. Barron of the University of Western Ontario gave us an excellent tour of the property.

Numerous prospectors and industry representatives provided useful information throughout the year, which is incorporated in this report.

D. McKay, Assistant Drill Core Library Geologist, was responsible for the preparation of the numerous samples required by this program. His efforts are gratefully acknowledged.

C. Komar typed this report and provided professional and efficient secretarial support throughout the year.

K.G. Fenwick, Manager, reviewed the report.

MINING ACTIVITY

Industrial mineral production in the Northwestern Region in 1989 is summarized in Table 8.1. Producing quarries and mines are shown on Figure 8.1.

GRANITE DIMENSION STONE

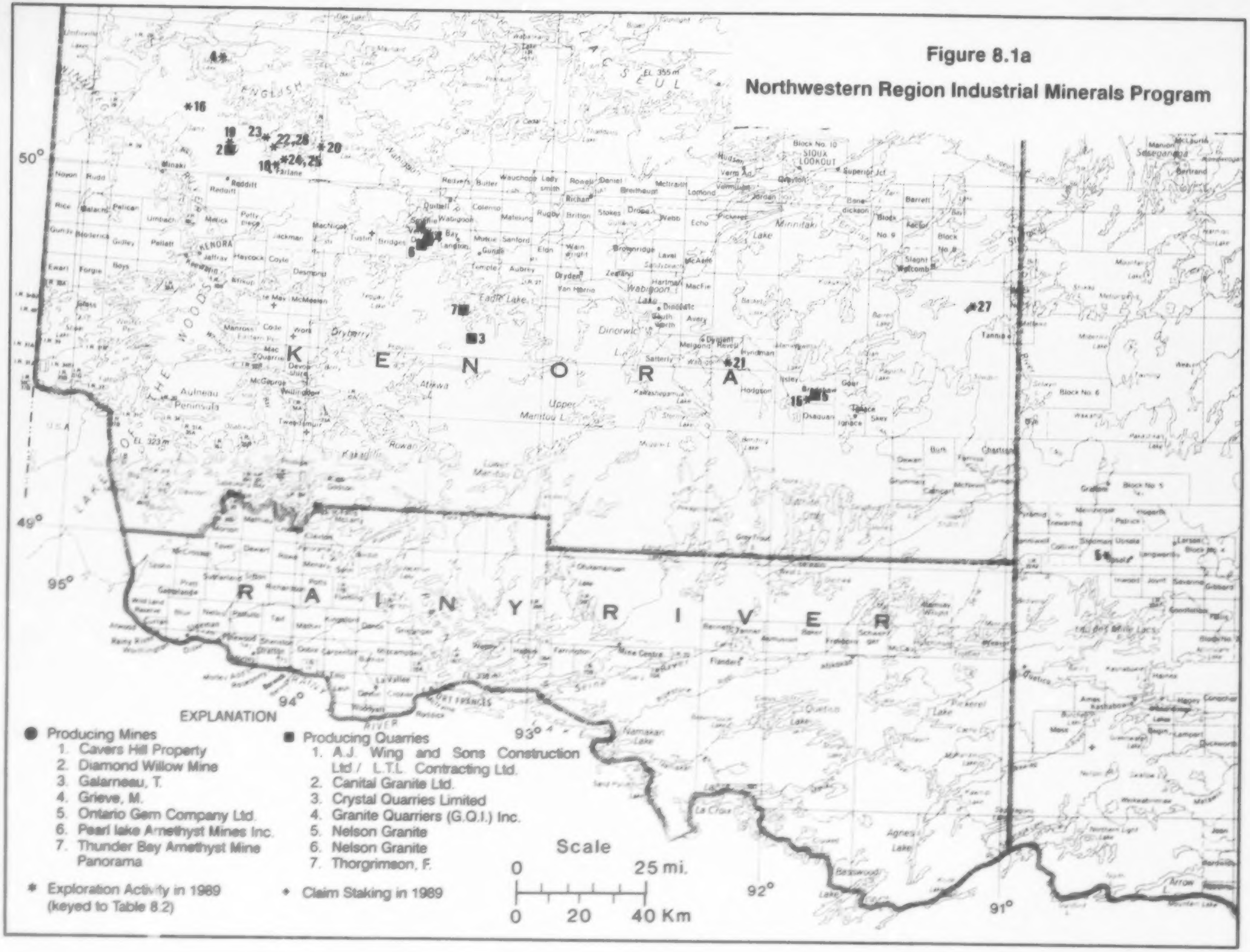
Vermilion Bay Quarries

Production continued from quarries located 12 km west-southwest of Vermilion Bay in Docker Township. Two companies, Nelson Granite and Granite Quarriers (G.Q.I.) Incorporated, extract the homogeneous, medium-grained, pink granite from quarries on opposite sides of the Trans-Canada highway. The deposit is located in a small granite plug within the Dryberry batholithic complex. The stone contains few fractures or joints, allowing blocks of any desired size to be quarried.

The Nelson Granite quarry operates year-round. Production in 1989 is estimated at approximately 3000 m^3 (100000 cubic feet). The majority of rough granite blocks produced are shipped to fabricating plants in eastern Canada, Winnipeg and a number of locations in the United States. The granite is used for both architectural and monumental applications. Nelson Granite processes some of the Vermilion pink granite at a small fabrication plant at the quarry site. Granite can be sawn, polished, split and trimmed at the plant, which is equipped with wire saws, a diamond trim saw, polishing machines and a hydraulic splitter. Some thermal finishing is done by hand with a small torch. Monuments and monument bases are the main products of the plant. Other products include pavers, landscaping pieces, curbing, tables, counter tops and other custom-ordered items. Nelson Granite carries out test sawing and polishing of stone from new granite deposits that the com-

Figure 8.1a

Northwestern Region Industrial Minerals Program


KENORA
RAINY RIVER
LAC SEUL
ENGLISH RIVER
LAKE OF THE WOODS
Upper Manitou L.
Minnitaki Lake
Eagle Lake
Wabigoon Lake
Dryden
Fort Frances
Sioux Lookout
Ignace
U.S.A.
50°
49°
95°
94°
93°
92°
91°
EL 355m
EL 323m
Scale
0
25 mi.
0
20
40 Km

EXPLANATION

- ● Producing Mines
  1. Cavers Hill Property
  2. Diamond Willow Mine
  3. Galarneau, T.
  4. Grieve, M.
  5. Ontario Gem Company Ltd.
  6. Pearl lake Amethyst Mines Inc.
  7. Thunder Bay Amethyst Mine Panorama
- ■ Producing Quarries
  1. A.J. Wing and Sons Construction Ltd / L.T.L. Contracting Ltd.
  2. Canital Granite Ltd.
  3. Crystal Quarries Limited
  4. Granite Quarriers (G.Q.I.) Inc.
  5. Nelson Granite
  6. Nelson Granite
  7. Thorgrimson, F.
- * Exploration Activity in 1989 (keyed to Table 8.2)
- ✦ Claim Staking in 1989

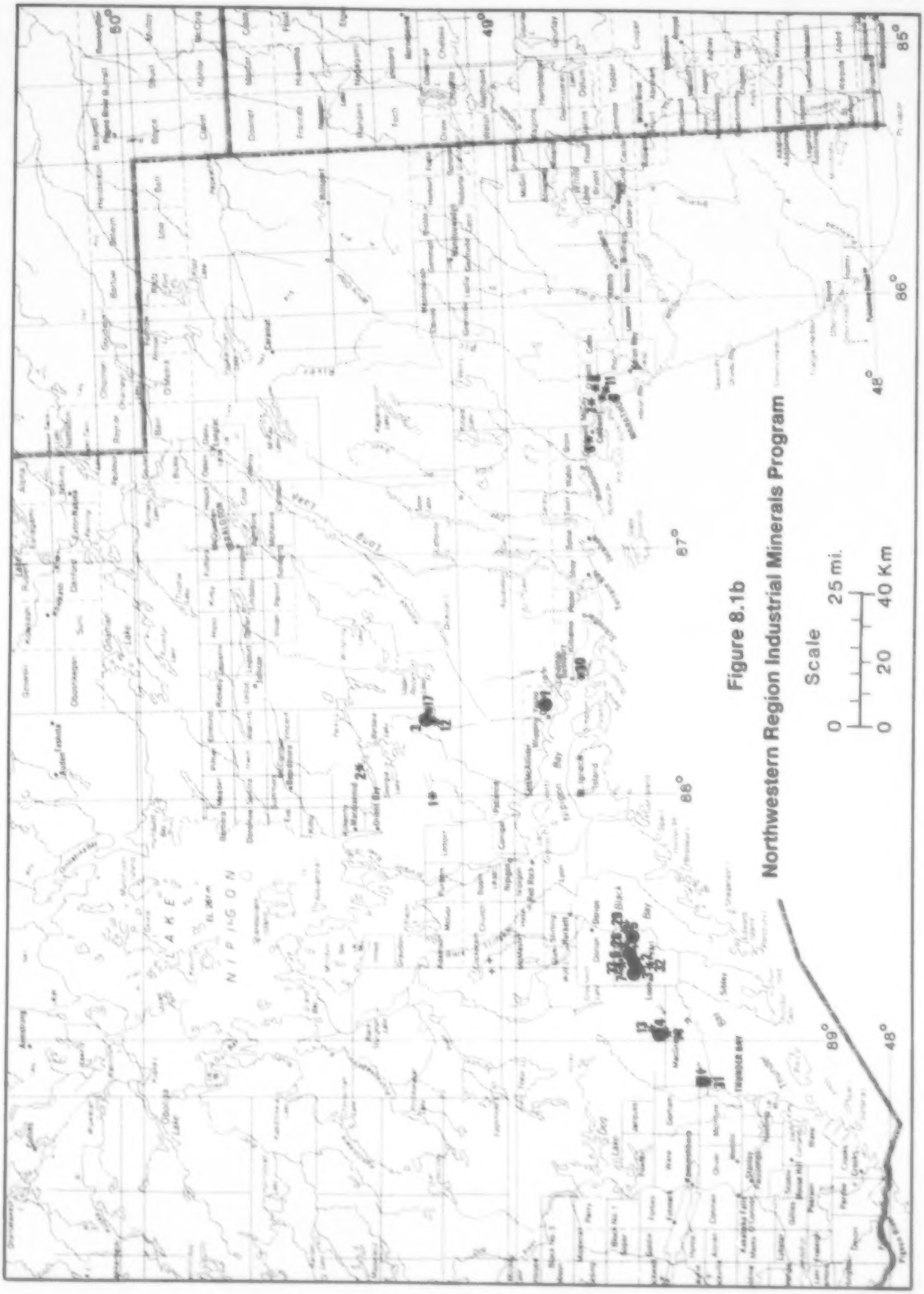


Figure 8.1b
Northwestern Region Industrial Minerals Program

Scale
0
25 mi.
0
20
40 Km
LAKE
NIPIGON
Nipigon Bay
Black Bay
THUNDER BAY
89°
88°
87°
86°
85°
48°
50°

TABLE 8.1. INDUSTRIAL MINERAL PRODUCERS AND SEASONAL PRODUCERS 1989.

Producer	Location	Commodity	Products/ Production
A.J. Wing and Sons Construction Ltd./ Contracting Ltd.	MacGregor Township	diabase	mineral wool raw material, L.T.I. construction material
Canital Granite Ltd.	Forgotten Lake	yellow granite	rough blocks, tiles, slabs; 600 m^3
Cavers Hill Property (Halonen Occurrence)	Yesno Township	amethyst	small amount produced
Crystal Quarries Limited	south of Eagle Lake	white quartz	crushed quartz, aggregate for architectural precast panels, landscaping stone; small amount produced
Diamond Willow Mine	McTavish Township	amethyst	specimens, decorative stone, aquarium stone; 30 tons produced
Galarneau, T.	Kabamichigama Lake	amethyst	specimens; small amount produced
Granite Quarriers (G.Q.I.) Inc.	Docker Township	pink granite	rough blocks; 1150 m^3
Grieve, M.	north of MacGregor Township	amethyst	specimens; small amount produced
Nelson Granite	Bradshaw Township	grey granite	rough blocks; 260 m^3
Nelson Granite	Docker Township	pink granite	rough blocks, slabs, monuments, pavers, landscaping items, curbing, specialty items; 3000 m^3
Ontario Gem Company Ltd.	McTavish Township	amethyst	specimens, slabbing and tumbling stone; 25 tons produced
Pearl Lake Amethyst Mines Inc.	McTavish Township	amethyst	decorative stone, slabbing/tumbling stone, specimens; 70 tons produced
Thorgrimson, F.	Eagle Lake	soapstone	carving stone; small amount produced
Thunder Bay Amethyst Mine Panorama	McTavish Township	amethyst	slabbing and tumbling stone, specimens, fireplace stone, landscaping pieces, faceting material; 4000 tons produced

pany is evaluating. Nelson Granite is a subsidiary of Nelson Monuments Limited of Sussex, New Brunswick. The company markets Vermilion pink granite under the name "Morning Rose".

Nelson Granite continued development of additional quarry sites in the Vermilion pink granite deposit. The new sites are located northwest of Nelson's producing quarry, on the southwest and northeast sides of Aaron Lake (*see* Kennedy and Sherlock 1988). Developmental work consists of jet channelling, block extraction and testing of the stone.

Granite Quarriers (G.Q.I.) Incorporated of Beebe, Quebec, produced approximately 1150 m^3 (40000 cubic feet) of Vermilion pink granite in 1989. The quarry was in operation from April to mid-December, under the direction of W. Rollins Jr. The company ships rough granite blocks to fabricating plants in Quebec and Vermont for production of monumental and architectural products (A. Probyn, Granite Quarriers (G.Q.I.) Incorporated, personal communication, 1989).

Ignace Quarry

Nelson Granite produced 260 m^3 (9000 cubic feet) of light grey granite from a quarry located 12 km northwest of Ignace in Bradshaw Township. Following initial production of a few granite blocks in 1988, stripping was carried out in order to further expose the granite ledge.

Quarrying was undertaken from September to December of 1989.

The new quarry is being developed within the property of the former Butler Station quarry, which was operated by the Wm. Horne Granite Company from 1915 to 1951. The property is owned by E. Hepp and J. Hepp of Duluth, Minnesota. Under agreement with the owners, Nelson Granite works three of the five patented claims. The property is described by Kennedy and Sherlock (1989).

The deposit is located within the Cecil Lake pluton. The stone is white to light grey in colour, fine grained and equigranular. Large blocks can be extracted.

The stone quarried this year is to be used in the construction of the new Ontario government building presently being built in Thunder Bay. A total of 3300 m^2 (35000 square feet) of thermal finished grey granite will be used in the building as architectural panelling, pavers and landscaping items. The stone cutting and finishing is being carried out in Winnipeg, Manitoba, and St. Cloud, Minnesota, under the direction of Universal Granite Systems Inc. The stone is scheduled to be installed on the building during the summer of 1990.

Forgotten Lake Quarry

Canital Granite Ltd. began production of yellow granite from this quarry in 1989. The company extracted 600 m^3 (21000 cubic feet) of stone in June and July. Previous exploratory and development work on the property was conducted by Nelson Granite, the property owner (*see* Kennedy and Sherlock 1989 and the Exploration Activity section of this report).

The quarry is located approximately 35 km north-northeast of Kenora on the west side of Forgotten Lake. Access is by the English River road.

The deposit is part of the Lount Lake batholith. The stone is a medium- to coarse-grained, porphyritic "granite" composed of yellow potassic feldspar phenocrysts in a matrix of plagioclase, potassic feldspar, quartz and biotite. On the whole, the rock is quite homogeneous, although some colour variation, a few streaky areas and a few inclusions were observed. Large blocks can be extracted from surface as the deposit is largely unfractured. The stone is an unusual colour and is suitable for both monumental and architectural applications.

The granite produced is to be used for the fabrication of tiles and slabs at Canital's granite plant in Winnipeg, Manitoba. The company plans to extract the yellow granite exclusively to supply the Winnipeg plant for the first three years of production, after which time blocks may become available on the market. The plant manufactures products with both polished and sandblasted finishes. Canital markets the granite under the name "Premiere" (Stone World, October 1989).

AMETHYST

Amethyst is produced on a seasonal basis from a number of mines in the Northwestern Region. Most amethyst production is from mines located in McTavish Township, northeast of Thunder Bay, which generally operate from May to October or November. The mineral supports a small, but important, industry in the Thunder Bay area. The mines do the majority of their business during the summer tourist season; most sell amethyst on site and several offer amethyst on a "pick-your-own" basis. The main commercial products of the mines are specimens, and slabbing and tumbling stone. Some of the mines sell decorative stone for fireplaces and architectural uses. Faceting grade (gem quality) amethyst is now being produced in the Thunder Bay area. Several retail outlets specialize in amethyst products including specimens, bookends, pen sets, jewellery, souvenirs and other giftware products. The mineral is the basis of a local craft industry.

Articles concerning amethyst in the Thunder Bay area appeared recently in *Lake Superior Magazine* (Campbell 1989) and *Lapidary Journal* (Zeitner 1989).

McTavish Township Mines

Thunder Bay Amethyst Mine Panorama, a division of Precious Purple Gemstones Ltd., is the largest amethyst producer in the area. Production in 1989 was approximately 4000 tons. Much of the mine's output was fireplace stone and decorative building stone. Specimens, tumbling and slabbing stone, and gem quality material are also produced. Production continued from the main open cut at the mine. A new zone which appears to be parallel to the main zone was discovered this year. Development at the mine included upgrading of the road and the settling pond system.

The mine employs seven seasonal people in production and at the shop and museum at the mine site. Three people are employed full-time at "Amethyst Factory", the company's Thunder Bay lapidary shop and production facility. In addition to amethyst products incorporating polished slabs and tumbling stone, 800 carats of faceted gemstones were produced; 400 carats of which are premium-grade stones.

Pearl Lake Amethyst Mines Inc. produced approximately 70 tons of amethyst this year, about one-half of which was decorative building stone. The rest consisted of slabbing and tumbling material, specimens and gem quality amethyst. Development at the mine included the construction of a workshop where amethyst slabs are sawn and polished. Finished products such as clocks and pen sets are now available for sale at the mine site in addition to rough material. Two new pits were opened up this year bringing the total number to seven, although most work continues from the main pit. Eight claims were brought to lease, additional claims were staked in the area of the mine and 0.8 km of new road was constructed. The mine has seven seasonal employees. (P. Durocher, Pearl Lake Amethyst Mines Inc., personal communication, 1989.)

Affiliated with the Pearl Lake Mine are Castagne's Rocks and Minerals shops. Amethyst products are made and sold at the shop on Highway 17. Castagne's has two retail outlets in the city of Thunder Bay, the second having opened this year.

Ontario Gem Company Ltd. produced in the order of 25 tons of amethystine material this year. Production was primarily for specimens, and slabbing and tumbling stone. The company makes its own fashion jewellery and sells its amethyst products, as well as local crafts, at a gift shop at the mine.

Diamond Willow Mine was worked by D. Noyes and M. Noyes. Production is estimated at 30 to 40 tons, consisting primarily of stone for fireplaces and rock gardens, specimens and aquarium stone. Some jewellery is also produced by the owners. The amethyst is sold at the mine site and distributed to a number of retail outlets. The mine had approximately 2000 visitors this summer. (M. Noyes, Diamond Willow Mine, personal communication, 1989.)

Dorion Amethyst Mine and the **Barrett Mine** were inactive this year.

Other Amethyst Producers

M. Grieve produced a small amount of amethyst for specimens from a property just north of MacGregor Township.

T. Galarneau produced a small amount of amethyst from a property on the Little Bear Quarry Road, near Kabamichigama Lake. He sells specimens at the mine site during the summer.

L. Halonen produced a small amount of amethyst from the Cavers Hill property in Yesno Township.

Little Bear Amethyst Mine, located 45 km northwest of Rossport in the Kabamichigama Lake area, was inactive this year.

QUARTZ

Crystal Quarries Limited produces white quartz from a quarry located south of Muskeg Bay, Eagle Lake. The crushed quartz is a specialty aggregate, sold primarily for use in precast concrete, exposed aggregate architectural panels and other products.

A small amount of the material was sold this year in Winnipeg and in the United States. Work at the quarry consisted primarily of stripping and other preparatory work as well as site clean up in order to eliminate contaminants. Approximately 1000 tons of quartz was drilled, blasted and stockpiled at the site. Some material has been hauled to Dryden for crushing in the spring of 1990. In addition, road upgrading was undertaken with the assistance of a grant from the Northern Ontario Resources Transportation Committee (NORTC). (E. Hansen, Crystal Quarries Limited, personal communication, 1989.)

DIABASE

In December 1988 and January 1989, 25000 tons of crushed and screened diabase were shipped to Sarnia, Ontario. A.J. Wing and Sons Construction Limited and L.T.L. Contracting Ltd. produced the material from a quarry located in MacGregor Township, just east of the limits of the city of Thunder Bay. The diabase was sold to Partek Insulation as raw material for the manufacturing of mineral wool used in insulation products suitable for high temperature applications such as pipe, tank and boiler wraps.

Further evaluation of the quarry's potential took place in 1989. This included diamond core drilling which has delineated an eight-year supply of the material suitable for the Partek process. The producers have 20000 tons of fine material of various sizes available for other uses. The fines are a by-product of the crushing for the mineral wool raw material.

In the past, diabase from the quarry has primarily been used for construction purposes and erosion control projects and to a lesser extent, for decorative building stone and for landscaping stone.

The south part of the quarry is owned by H. Epp of Thunder Bay. No diabase was produced from this part of the quarry in 1989. Blocks for restoration of the Thunder Bay harbour breakwater were extracted in 1988 (H. Epp, personal communication, 1989).

SOAPSTONE

F. Thorgrimson of Keewatin extracted a small quantity of soapstone for carving from the waste dump of the past-producing Eagle Lake soapstone quarry. The Eagle Lake soapstone occurrence is described in Kennedy and Sherlock (1989). Thorgrimson carves Indian ceremonial pipes and a variety of other ornamental objects.

MARBLE

The LunMac Rock marble quarry near Eaglehead Lake, north of Thunder Bay, was inactive this year. LunMac annually removes a small quantity of decorative stone from the property for the production of clocks, bookends and other ornamental objects. The "marble" occurs in a variety of colours including blue-grey, white, brown and multicoloured. The property is described in Patterson et al. (1985).

FLAGSTONE

The flagstone quarries located in Forgie Township, west of Kenora, were inactive in 1989. Flagstone was previously extracted from two quarry sites by Don Barnard Enterprises and Lunam Drillers Ltd. The material is used for decorative facing stone and patio stone.

EXPLORATION ACTIVITY

Exploration activity for industrial minerals in the Northwestern Region is summarized in Table 8.2. The locations of exploration projects are indicated on Figure 8.1.

GRANITE DIMENSION STONE

Exploration for dimensional stone took place across the region. The principal targets are the diverse coloured

TABLE 8.2. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure 8.1	Individual or Company (Location)	Activity
1.	Armeno Resources Inc. (Hanson Lake and Cosgrave Lake) (MNW Property)	assays, whole rock analyses, mineralogy, VLF-EM, radiometric survey, beneficiation studies
2.	Armeno Resources Inc. (Lake Jean) (Foster-Lew Property)	diamond drilling
3.	Bak, David M. (McTavish Township)	stripping, trenching
4.	Bellwether Resources Ltd. (Treelined Lake)	beneficiation studies, EM, Mag, trenching, sampling
5.	Bumbu, Costy (Hay Lake)	power stripping
6.	Cold Spring Granite (Canada) Ltd. (Coldwell Township) (Coldwell Property)	test block removal, bulk sample testing (beneficiation studies), diamond drilling, ASTM testing, ground probing radar
7.	Cold Spring Granite (Canada) Ltd. (McCoy Township) (Angler Property)	stripping, test block removal, bulk sample testing (beneficiation studies), ASTM testing, diamond drilling
8.	Cold Spring Granite (Pic Township) (O'Neil Black Property)	diamond drilling
9.	Cold Spring Granite (Seeley Lake, Pic Township, McCoy Township)	ground probing radar
10.	Coppola, Ted (Canital Granite Ltd.) (Wonderland Lake) (Red Deer Lake property)	market evaluation
11.	Culhane, Patrick (Palin Granite) (Pic Township)	AEM, airborne mag surveys
12.	Dampier, Gerard (Kabamichigama Lake)	stripping
13.	Grieve, Michael D. (MacGregor Township)	stripping, trenching
14.	Harty Richard Harty, Onni (MacGregor Township)	stripping, trenching
15.	Hep[illegible], James and Eileen (Bradshaw Township)	stripping
16.	Kenora Gold Occurrences Inc. (G. Zebruck) (Snook Lake)	test block removal, beneficiation studies
17.	Laporte, Eldon (Kabamichigama Lake)	stripping
18.	Nelson Carter (Docker Township)	beneficiation studies
19.	Nelson, Carter (Forgotten Lake)	beneficiation studies, market evaluation
20.	Nelson, Carter (Kilgour Lake)	stripping, test block removal

TABLE 8.2. CONTINUED.

Number on Figure 8.1	Individual or Company (Location)	Activity
21.	Nelson, Carter (Revell Township)	geology
22.	Nelson, Carter (Wonderland Lake) (Boulder Hill Property)	stripping
23.	Nelson, Carter (Wonderland Lake) (Muskeg River Property)	stripping
24.	Nelson, Carter (Wonderland Lake) (Red Deer Lake Property)	test block removal
25.	Nelson, Carter (Wonderland Lake) (S.E. Red Deer Lake Properties)	stripping, test block removal, beneficiation studies
26.	Nelson, Carter (Wonderland Lake) (Wonderland Property)	stripping
27.	Parker, Doug (Surprise Lake)	
28.	Pearl Lake Amethyst Mines (McTavish Township)	stripping, trenching
29.	Redden, J.W. (McTavish Township)	VLF, EM, stripping
30.	Seeber, Walter (Digregorio, Silvio) (Rossport)	diamond drilling
31.	Tetlock, B.J. (MacGregor Township)	chemical analyses
32.	Twomey, Timothy (McTavish Township) (Big Pearl Lake Property)	stripping
33.	Twomey, Timothy (McTavish Township) (Breezy Lake Property)	stripping

granitic rocks found north of Kenora, the white and grey granitic rocks from the Ignace–Dryden area and the dark-coloured syenites of the Marathon area. The most significant exploratory work carried out in 1989 is described below.

Lount Lake Batholith

A number of stone deposits are being investigated within the Lount Lake batholith, located north of Kenora. The batholith is a large (2058 km^2), complex, syntectonic to late tectonic pluton composed primarily of massive porphyritic granodiorite and quartz monzonite (Breaks et al. 1978). The batholith has tremendous dimension stone potential for granite of a variety of colours including red, brown, yellow and pink. The deposits comprise largely unfractured, massive phases of the batholith; they are commonly porphyritic. The colour of the stone is determined by the colour of the potassic feldspar phenocrysts. Previous work in the area is described in Kennedy and Sherlock (1988, 1989).

Nelson Granite continued to evaluate a number of properties within the batholith. A bulk sample was extracted near Lila Lake, northwest of Red Deer Lake, for testing purposes. On two claim groups southeast of Red Deer Lake, stripping was carried out, test blocks were removed, and sawing and polishing tests were performed on the samples. Stripping and cleaning of outcrops was carried out on three properties which are located: north of Red Deer Lake; near Wonderland Lake; and on the Muskeg River. Outcrop stripping and test block removal was also carried out near Jones Road in the Kilgour Lake area. These properties comprise a variety of colours of granite including brown, grey-brown and red.

At the Forgotten Lake yellow granite property, Nelson Granite removed blocks and performed sawing, polishing, flame finishing and high-pressure water cutting tests on the samples. Samples were made and distributed for market evaluation.

Canital Granite Ltd. distributed samples of brown granite from its property in the Red Deer Lake area for market testing. The company received favourable results concerning the marketability of the stone. The samples were from blocks extracted by Canital in 1987.

Kenora Gold Occurrences Inc. removed several large blocks of granite from the Snook Lake property. Sample tiles were prepared of the porphyritic red granite and physical properties (American Society for Testing and Materials (ASTM)) testing was carried out. Kenora Gold received a grant under the Resource Diversification and Development Subprogram of NORFUND to carry out this work. The Snook Lake property is described in Kennedy and Sherlock (1989). The property is optioned from G. Zebruck of Kenora who previously carried out geological and radiometric surveys on the deposit. The radiometric survey proved very useful in delineating the boundaries of the granitic plug which is hosted in gneissic rocks. The total gamma ray count in the granite is notably higher than in the gneisses due to the potassic feldspar content of the granite.

Palin Granite Canada Inc. holds several properties in the area. The company plans to conduct airborne magnetic, gradiometric and radiometric surveys over these properties.

Revell Batholith

Nelson Granite continues to evaluate a white granite deposit located adjacent to the Trans-Canada highway near Borups Corners, between Ignace and Dryden. The deposit is a medium-grained, equigranular, white granodiorite containing up to 10 percent biotite. A geological survey was carried out in 1989. Previous work includes extensive stripping, removal of a bulk sample, and performance of a variety of tests on the granite (*see* Kennedy and Sherlock 1989). Nelson Granite will market this stone under the name "Arctic White".

Cecil Lake Pluton

Evaluation work was carried out by E. Hepp and J. Hepp on a pink granite property in Bradshaw Township on claims south of, and adjacent to, the claims encompassing the Butler quarry. The work involved stripping, and drilling and splitting of blocks.

Coldwell Alkalic Complex

Potential deposits of black, brown, green and red "granite" are found in the Marathon area. They represent different syenitic phases of the Coldwell alkalic intrusive complex. Commercial granite was produced from a number of sites in the area from 1928 to 1932. The history of stone quarrying near Marathon is summarized in Patterson et al. (1985).

Cold Spring Granite (Canada) Ltd. worked on three granite properties in the complex; the Coldwell Red property, the Angler Black property and the O'Neill Black property. Test blocks removed from the Coldwell and Angler properties were subjected to a variety of tests including sawing and polishing tests, thermal finishing and physical properties (ASTM) testing. Samples and a test monument were also manufactured at the plant in Cold Spring, Minnesota. The results of all tests were favourable. These two granites have been given the names "Canadian Red" and "Canadian Black" by Cold Spring.

Ground probing radar and diamond drilling was performed on the properties in order to evaluate fracturing and colour of the deposits. Forty-four holes totalling 594.5 m (1950.5 feet) were drilled; 33 holes on the Coldwell property, 10 on the Angler property and 1 on the O'Neill property. Results have not yet been reported.

Cold Spring received a grant under the Resource Diversification and Development Subprogram of NORFUND for evaluation of these properties.

Airborne magnetic and airborne electromagnetic surveys were conducted over a black granite property held by Palin Granite Canada Inc.

AMETHYST

Exploration for amethyst occurred in several areas with McTavish Township as the centre of most prospecting for the mineral. The various producers in the township, in particular, Pearl Lake Amethyst Mines Inc. and Thunder Bay Amethyst Mine Panorama, continued exploration and development work near their mines and on other properties. J. Redden carried out stripping and a very low frequency electromagnetic (VLF-EM) survey on a property which includes the former Caribou Mine, a lead-zinc occurrence, in addition to amethystine quartz veins. T. Twomey did some stripping on two amethyst properties in McTavish Township: the Big Pearl Lake property and the Breezy Lake property. Stripping and trenching were carried out on another property by D. Bak.

In the MacGregor Township area, stripping and trenching were carried out on properties owned by M. Grieve, and R. Harty and O. Harty.

G. Dampier and E. Laport worked on amethyst properties in the Kabamichigama Lake area.

SILICA

W. Seeber continued to explore the potential of a silica deposit on Quarry Island in Lake Superior south of Rossport. Work in 1989 consisted of diamond drilling to further delineate the extent and quality of the orthoquartzite. Two holes, totalling 62.2 m (204 feet), were drilled.

A consultant's report prepared in 1985–86 indicated reserves of 10 to 20 million tons with preliminary grades of greater than 98 percent SiO_2 and a fairly low iron content.

The white orthoquartzite on Quarry Island was quarried for building stone during the late 1880s.

LITHIUM

Armeno Resources Inc. has been actively exploring a number of lithium properties in the Georgia Lake area south of Beardmore since 1983 (*see* Kennedy and Sherlock 1988, 1989). Work reported in 1989 was carried out on the Foster–Lew, Jean Lake and M.N.W. deposits. Chemical and mineralogical analyses of samples from the Jean Lake and M.N.W. deposits indicate an overall lithia content of 1.25 percent and 4.44 percent, respectively, with spodumene as the only lithium mineral present. VLF-EM and radiometric surveys were carried out on the M.N.W. deposit, however, they were unsuccessful in locating or delineating the lithium pegmatite. One hole, 48.77 m (160 feet), was drilled on the Foster-Lew deposit; it intersected narrow pegmatite veins with minor spodumene.

The spodumene pegmatites in the Georgia Lake area were discovered and extensively explored in the mid-1950s. There has been little activity in the area until recently when anticipated increases in demand for lithium metal, ceramic-grade spodumene and rare elements renewed interest in the pegmatites. The common minerals of the pegmatite dikes are microcline, perthite, albite, quartz, spodumene and muscovite. Accessory minerals are apatite, beryl, bityite, clevelandite, columbite, garnet, huhnerkobelite, molybdenite, petalite, purpurite, sericite, talc, tourmaline and minor lepidolite and amblygonite (Hewitt 1967; Milne 1962; Breaks 1980).

DECORATIVE STONE

Quartz

C. Bumbu continued to examine the Hay Lake quartz occurrence, located approximately 6 km west of Upsala. Work in 1989 consisted mainly of stripping.

The quartz is hosted within Archean intermediate to mafic metavolcanic rocks which are metamorphosed to greenschist facies. The sequence is part of the Upsala-Firesteel River belt (Sage et al. 1974).

The main showing trends 300° and occurs in a ridge approximately 200 m in length. Trenching at the southeastern end of this ridge exposed a 12 m wide section of the vein with a 6.6 m wide zone of pure white quartz. This zone can be traced for the length of the ridge; at the northwestern end it narrows to 3.5 m.

Red Granite

Crystal Quarries Limited conducted initial development work on a decorative red granite deposit on the Cygnet Lake road, approximately 40 km northwest of Kenora. Outcrop stripping and washing, and road preparation were carried out. Crystal Quarries plans to develop a quarry to produce crushed bright red granite for specialty aggregate applications, such as, exposed aggregate concrete.

GRAPHITE

Work continued on the Black Sturgeon graphite property near Treelined Lake, 60 km north of Kenora. The property which was optioned to Bellwether Resources Ltd. has been returned to owners G. Zebruck and R. Kuehnbahm. (G. Zebruck, Prospector, personal communication, 1989.)

The graphite-bearing structure which has been identified by geology and geophysics programs has a width of greater than 100 m and a strike length of 3 km. Sampling from two trenches across the structure returned values ranging from 0.08 to 6.94 percent carbon. One trench included a 18 m section grading 3.72 percent carbon.

Graphite mineralization is concentrated along shear zones and is disseminated within the meta-arkose bands. The grade of the deposit varies between units with the higher grade, coarse-flake graphite occurring within the coarser grained units. The property is described in more detail in Kennedy and Sherlock (1989).

INDUSTRIAL MINERALS STAFF ACTIVITIES

The Industrial Minerals Program staff consists of M. (Kennedy) Gerow, Industrial Minerals Geologist and J. Bellinger, Assistant Industrial Minerals Geologist. E. Sherlock held the position of Assistant Industrial Minerals Geologist until September 30, 1989.

General activities undertaken by the Industrial Minerals Program staff include monitoring industrial mineral activities, collecting data and compiling information concerning occurrences and deposits, and consulting with prospectors, industry representatives, Resident Geologists' staff and the public.

Work continued on the soapstone study initiated in 1988. A stone study for the Ignace area was also undertaken in 1989. Preliminary results of these two studies are reported in the Research by Industrial Minerals Staff section of this report.

A total of 29 property visits were made in 1989. These are listed in Table 8.3 and located on Figure 8.2.

Field trips were led to Vert Island and La Grange Island in Nipigon Bay of Lake Superior, and to the Ignace area and Dog Lake.

A talk outlining regional industrial mineral activities was delivered at the Northwestern Ontario Mines and Minerals Symposium in February. Presentations were also made to prospecting classes in Thunder Bay and Beardmore, and in conjunction with Careers Day activities at a public school.

Two poster displays, "Industrial Minerals Activities-Northwestern Region, 1988" and "Early Stone Industry, Northwestern Ontario", were presented at the regional seminar. A poster display depicting industrial minerals activities for 1989 was presented at the Ontario Mines and Minerals Symposium in Toronto in December. The industrial minerals poster was also exhibited at the annual meeting of the Institute on Lake Superior Geology in Duluth, Minnesota. A poster display entitled "Women in Geology" was presented at Lakehead University's Career Exposé.

Two industrial minerals conferences were attended: the Quebec Industrial Minerals Symposium in Quebec City and Industrial Minerals '89 in Toronto. A visit was made to the Granicor Granite fabrication plant in connection with the Quebec conference. In addition, the annual meeting of the Canadian Institute of Mining and

TABLE 8.3. PROPERTY VISITS—INDUSTRIAL MINERALS PROGRAM (keyed to Figure 8.2).

1. Adrian Township Occurrence (talc)
2. Angler Property—Cold Spring Granite (black granite)
3. Bradshaw Township Property—E. and J. Hepp (pink granite)
4. Butler Quarry—Nelson Granite (grey granite)
5. Cavers Hill Property—L. and V. Halonen (amethyst)
6. Claxton Township Occurrence (soapstone)
7. Coldwell Property—Cold Spring Granite (red granite)
8. Coste Island (French Portage Narrows) Occurrence (soapstone)
9. East End Silver Mountain Mine (fluorite, barite)
10. Falcon Island Occurrence (black sand)
11. Gummeson Occurrence—Palin Granite (grey granite)
12. Kingfisher Lake Property—E. Williamson (pegmatite)
13. LeMay Township Property—G. Zebruck (diabase)
14. Northern Light Lake Occurrence (talc)
15. O'Neill Township Property—D. Wilkinson (black granite)
16. Ouimet Marble Occurrence (pink marble)
17. Cold Spring Granite (white granite)
18. Phillips Township Occurrence (soapstone)
19. Pipestone Peninsula Occurrence (soapstone)
20. Preachers Lake (Spring Lake) Occurrence (talc)
21. Red Deer Lake Property—Nelson Granite (brown granite)
22. Revel Township Property—Nelson Granite (white granite)
23. Rocky Islet Bay Occurrence (talc)
24. Springpole Lake Property—Gold Fields Canadian Mining Ltd (fluorite) (*see* Atkinson et al., this volume)
25. Sunrise and Sunset Veins (fluorite)
26. Thunder Bay Amethyst Mine Panorama (amethyst)
27. Tustin Township Property—G. Zebruck (pegmatite)
28. Upper Shebandowan Lake Occurrence (talc)
29. Work Township Property—G. Zebruck (diabase)

Metallurgy in Quebec City and the Prospectors and Developers Association annual convention in Toronto were attended.

In conjunction with the Ministerial Review of Ontario's Industrial Minerals Industry, visits were made to Cold Spring Granite Company and Universal Granite Systems Inc. in Minnesota, and Canital Granite Ltd. in Manitoba, and meetings were held with a variety of northwestern Ontario's industrial mineral producers.

The Industrial Minerals Geologist was involved with the Ignace Corridor Strategy Steering Committee and a proposed granite curbing demonstration project.

PROPERTY EXAMINATIONS

Springpole Lake Fluorite-bearing Carbonatite

by D.M. Conrod

Project Officer, Mineral Development Section, Mineral Development and Lands Branch, Ministry of Northern Development and Mines

The Springpole Lake property is located approximately 110 km northeast of Red Lake, within the Birch Lake greenstone belt, and geologically represents a small alkaline volcanic centre. This volcanic centre consists of coarse-grained, porphyritic trachyte flows; lapilli, ash and agglomeratic pyroclastic deposits; proximal vent breccias; intrusive syenitic bodies; biotite lamprophyric dikes; and fluorite-bearing, sovitic-type, carbonatite bodies. These extrusive and intrusive lithologies together compose what is referred to as the Springpole alkalic volcanic complex (Barron et al. 1989).

Flows and pyroclastic deposits of the complex unconformably overly the older Archean metavolcanic rocks of the area, and the complex is overlain by Timiskaming-type metasedimentary rocks.

A lead isotope age of 2718 Ma was obtained from disseminated galena within the carbonatite (Barron et al. 1989).

Porphyritic syenite and trachyte are the most abundant lithologies of the complex. Barron et al. (1989) have proposed that the syenitic dikes represent feeders to viscous, porphyritic, trachyte flows. The pyroclastic rocks of the complex include monolithic to heterolithic agglomerates, breccias, lithic tuffs, crystal tuffs and ash deposits.

The fluorite-bearing carbonatite intrusion accounts for only a small portion of the complex. It is exposed on surface at two locations (Figure 8.3), however, Barron et al. (1989) reported a strike length of at least 1.5 km. The carbonatite is in sharp contact with the surrounding, fenetized, country rock breccias. Weather-resistant xenoliths of breccia and syenite, within the carbonatite, give the exposed surfaces of the carbonatite a rough appearance. Fluorite occurs as fine disseminations and stringer veinlets within the carbonatite and adjacent fenitized breccias. In addition to calcite and fluorite, the carbonatite may also contain up to several percent barite and quartz. In the exposed portion of the carbonatite, fluorite averages 10 to 15 volume percent of the rock.

Fenitization is pervasive throughout the area and is particularly intense near the carbonatite.

The investigation of fluorite and barite resources in Ontario is being undertaken as part of COMDA-funded studies of industrial minerals used in the inorganic chemicals industry (Law et al. 1989).

French Portage Narrows (Coste Island) Soapstone Occurrence

This soapstone occurrence is located on a small island situated between the southeastern part of Coste Island and the Aulneau Peninsula in Lake of the Woods. It is accessible by boat (*see* Figure 8.2).

The soapstone occurs within fine-grained, dark green, pillowed and massive metavolcanic basaltic rocks. The soapstone is a dark grey-green colour, fine grained, soft and moderately fractured. The fracture pattern only allows for the extraction of small blocks. The unit is approximately 2 m wide and is exposed for 50 m along the southeast shore of the island.

Wilson (1926) reported that local native groups used the stone to make ceremonial pipes and other small items. In 1975, F. Thorgrimson of Keewatin held a quarry permit on the ground to extract a small amount of carving material. The only workings on the occurrence consist of a small pit (1 m wide) where material has been removed.

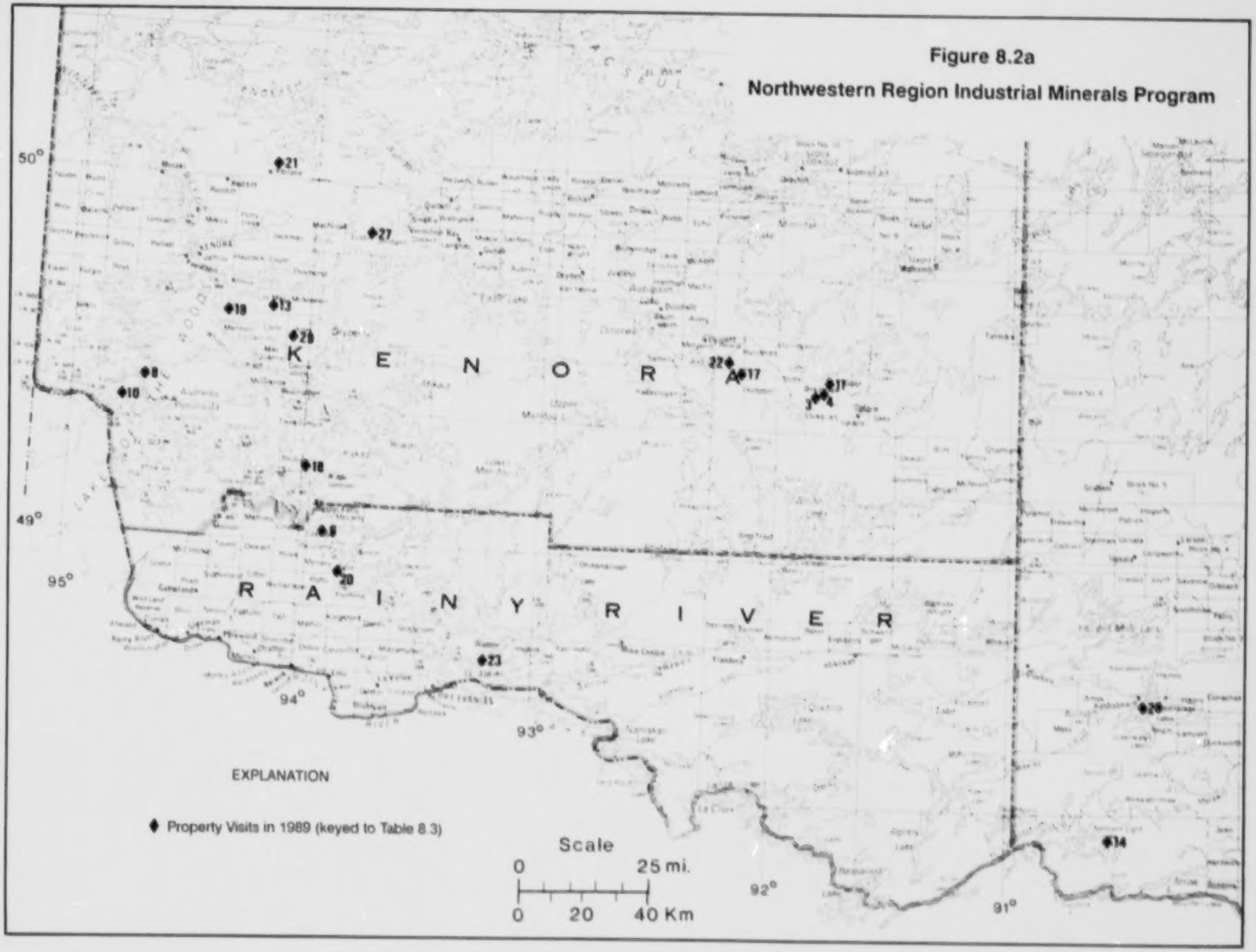

K E N O R A
R A I N Y R I V E R
21
27
19
13
28
8
10
18
6
20
23
22
17
11
3
4
26
14
50°
49°
95°
94°
93°
92°
91°
Scale
0
25 mi.
0
20
40 Km

Figure 8.2a

Northwestern Region Industrial Minerals Program

EXPLANATION

♦ Property Visits in 1989 (keyed to Table 8.3)

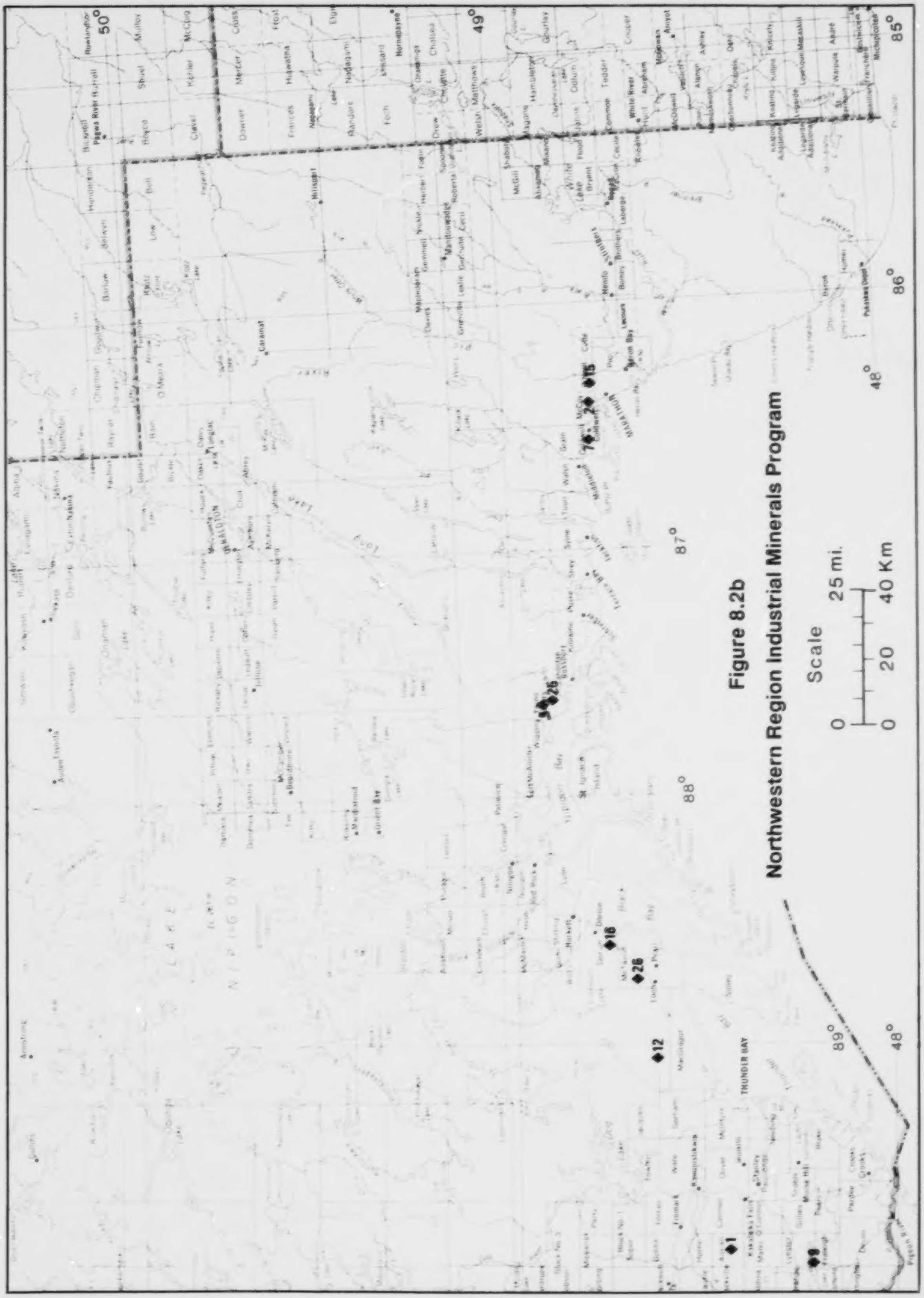

Scale
0
20
25 mi.
40 Km
50°
49°
48°
89°
88°
87°
86°
85°
LAKE NIPIGON
THUNDER BAY
1
8
12
18
26
3
25
7
24
15
Marathon
Pagwa River
Hillsport
Manitouwadge
White River
Michipicoten
Pukaskwa
Caramat
Pigeon River

Figure 8.2b
Northwestern Region Industrial Minerals Program

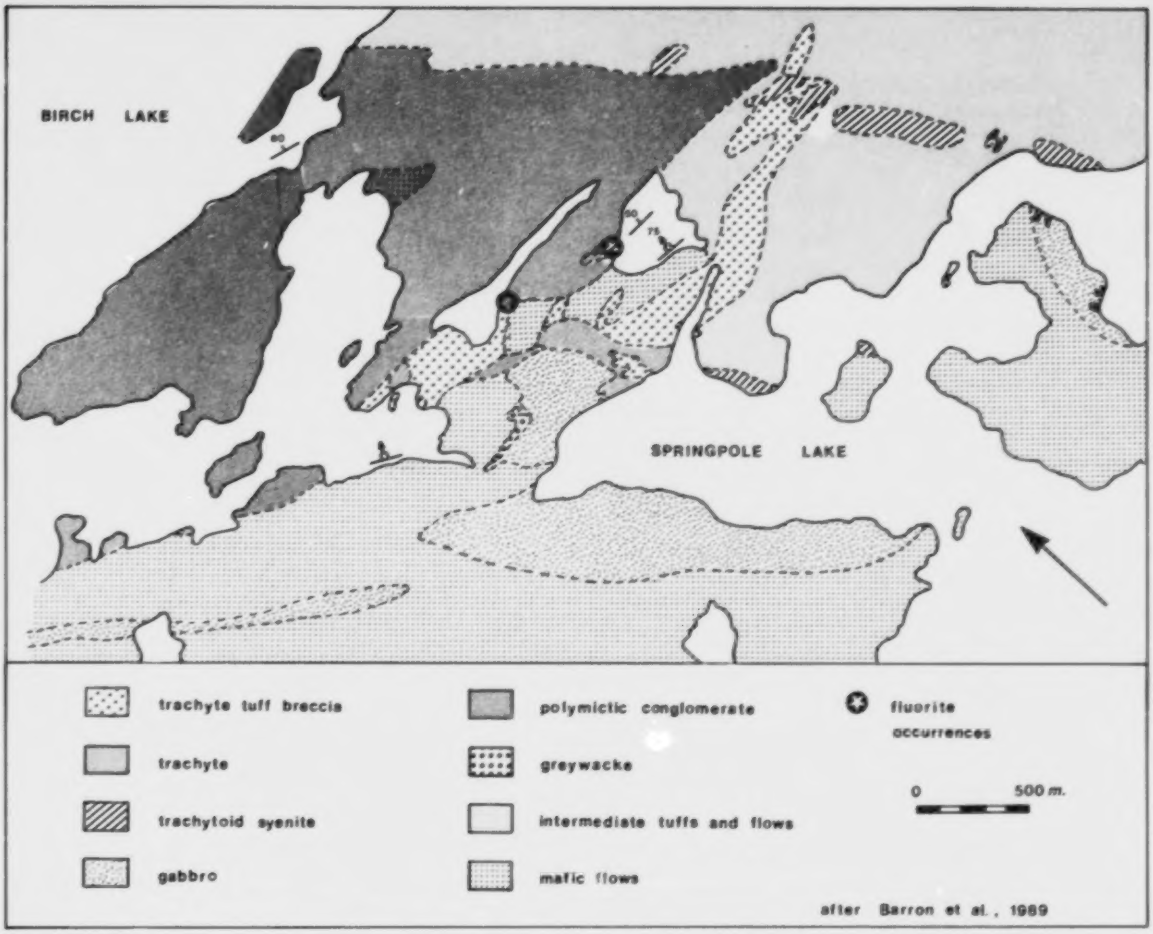


Figure 8.3. *Springpole Lake alkalic volcanic complex.*

Pipestone Peninsula Soapstone Occurrence

This soapstone occurrence is located in Manross Township within the Pipestone Park Reserve, on Pipestone Peninsula of Lake of the Woods. The occurrence is accessible by boat (*see* Figure 8.2).

The peninsula is underlain by mafic metavolcanic rocks and metamorphosed ultramafic intrusive rocks (Ayer et al. 1985). The soapstone occurs within the ultramafic units.

The soapstone is a dark grey colour, distinctly foliated and locally very fractured. The talc content varies along strike resulting in variations in the softness of the unit. Iron carbonate veins occur throughout the unit. Old workings offer the only exposure of the soapstone.

Small-scale production of soapstone occurred in 1915. It consisted of the removal of blocks for use in lining soda smelting furnaces. As the material proved to be unsuitable for this purpose, only small amounts, primarily used for carvings, have since been removed (Storey 1986).

RESEARCH BY INDUSTRIAL MINERALS STAFF

SOAPSTONE STUDY

A study of soapstone in Ontario is being conducted by the Industrial Minerals Program staff. The study, initiated in 1988, will incorporate up-to-date market data and descriptions of soapstone occurrences from across the province. Input will be provided by Resident Geologists' offices in the Northeastern and Southern regions and by Mineral Development and Lands Branch staff.

In 1988, the major soapstone occurrences in northwestern Ontario were visited. These are described in Kennedy and Sherlock (1989). A number of smaller soapstone and talc occurrences in the region were visited during the summer of 1989. These are included in Table 8.3. In addition, the history of the various properties has been researched and samples have been submitted for chemical analysis and carving tests. Two of the occurrences visited this year are described briefly in the Property Examinations section of the report.

The study was initiated due to increased interest in soapstone and a perceived increase in demand for the material for artistic applications, ornamental uses and for heating and cooking systems.

Soapstone is defined as an impure, massive, compact form of talc, which can be easily sawn or machined. The composition tends to be a mixture of talc, serpentine, chlorite and dolomite, with small percentages of quartz and calcite. Soapstone is characterized by its softness, resistance to chemical and thermal decomposition, and high heat capacity (Prud'homme 1987).

In North America, indigenous people were the first to recognize the ease in shaping soapstone and began quarrying it on a small scale to fashion pipes, bowls, pots and other small utensils. The tradition of carving stone remains very popular amongst aboriginal and other artists.

Historically, soapstone has been used in applications utilizing its chemical and thermal inertness, such as in furnace linings, in pulp mills, table tops and sinks for laboratories, residential heating and cooking stoves, as well as a variety of other uses. Soapstone has been replaced in most of these applications by improved technology and better materials.

Recently, however, soapstone stoves and fireplaces have been gaining popularity in Europe and North America. This is possibly due to the high efficiency and cleaner burning character of these stoves, as well as aesthetic appeal. One company experiencing much success with soapstone stoves is Suomen Vuolukivi Oy of Finland. The soapstone from their Finnish quarries is marketed under the commercial name of Tuli Kivi (meaning Fire Stone) and is fabricated into a variety of items, in addition to many types of stoves, including cookware, giftware and tile. The fireplace and stove units are sold as kits to be assembled by the consumer or distributor. Suomen Vuolukivi Oy has anticipated a large market for their products in North America and, rather than continue shipping kits from Finland, they have acquired and reopened the Alberene Soapstone Quarry in Virginia, USA (Dimensional Stone, Volume 4, Number 7, October 1988). Manufacturing takes place in the modernized plant at the quarry site.

There appears to be an increasing demand for soapstone for carving and other ornamental applications. Stone Studio Siku of Parry Sound creates attractive soapstone products which are carved and etched, including plaques, boxes and lamps. Their products are widely distributed. Several Canadian producers, such as Baker Talc (LPB) Inc. and LUZCAN Inc., sell soapstone for carving purposes. The stone is a by-product of talc mining operations and is only produced in small quantities.

It is hoped that this study will provide useful information regarding the potential of Ontario's soapstone occurrences as sources of dimensional stone and carving stone.

IGNACE AREA STONE STUDY

An evaluation of stone resources in the Ignace area was initiated this year. The study is being carried out at the request of the Ignace Community Development office. Recent developments in the stone industry in the area, including the reopening of the former Butler Station quarry (*see* Mining Activity section of this report) and exploration and staking activity for granite in the area, illustrate the renewal of interest in the Ignace area granite dimension stone resources.

Previous workers, including Storey (1986) and Wong and Oliver (1982), and work by the staff of the Sioux Lookout Resident Geologist's office, have examined stone occurrences in the Ignace area, but no comprehensive report has been produced. This study will incorporate the previous work with current findings and observations.

Granitic rock outcrops were examined in the Upsala to Ignace area; accessible by Highway 17, and north and east of Ignace in areas accessible by Highway 599 and the Graham Road (*see* Figure 8.4).

The area lies within the Wabigoon granite-greenstone subprovince. The general geology is shown on Figure 8.4. Granitic rocks in the area are most commonly grey to white in colour.

A number of plutons were examined including the Revell batholith, Cecil Lake pluton (Indian Lake batholith), Basket Lake batholith, McCausland Lake pluton, Metionga Lake pluton, Harmon Lake pluton (Wapakaimaski Lake pluton), Stedman Lake pluton, Valora-Jigger lakes stock and White Otter Lake pluton. These are also shown on Figure 8.4.

Areas of high potential for granite dimension stone development were identified. These are described below. Samples were collected and cut and polished. Slabs (9 by 15 cm) have been prepared for the various sites. These samples will be available for viewing at the Ignace Community Development office and the Thunder Bay Mineral Resources office when the study is complete.

The plutons which appear to have areas of high granite dimension stone potential are the Revell batholith, Cecil Lake pluton, Harmon Lake pluton and Stedman Lake pluton. In addition, an area of unfractured gneissic rocks was identified near Harmon Lake.

Revell Batholith

The Revell batholith is an elongate granitoid body which trends roughly northwest. It appears to comprise a number of different granitic phases varying from white to grey to pink in colour. The north part of the batholith is predominantly massive, white to grey, generally medium-grained granodiorite with varying biotite content. At some locations, a weak fabrication in the rock is defined by alignment of the biotite grains. This northern part of the batholith has excellent potential for dimension stone quarrying. Nelson Granite is evaluating a site approximately 45 km northwest of Ignace at the junction of Highway 17 and the Basket Lake Road described in the Exploration Activity section of this report. D. Pe-

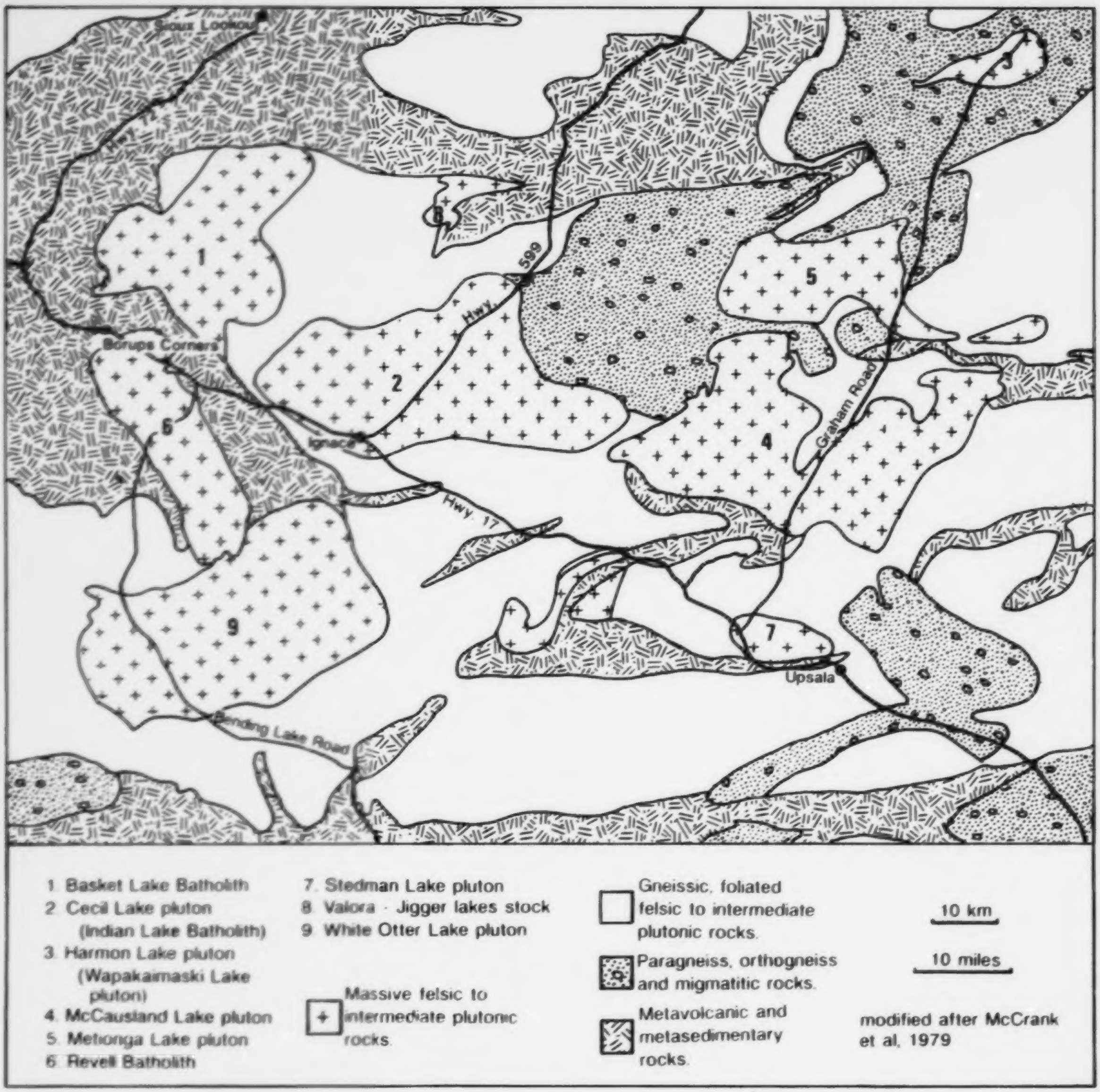

Sioux Lookout
Hwy 72
Borups Corners
Ignace
Hwy. 599
Hwy. 17
Graham Road
Upsala
Bending Lake Road
1
2
3
4
5
6
7
8
9
1. Basket Lake Batholith
2. Cecil Lake pluton (Indian Lake Batholith)
3. Harmon Lake pluton (Wapakaimaski Lake pluton)
4. McCausland Lake pluton
5. Metionga Lake pluton
6. Revell Batholith
7. Stedman Lake pluton
8. Valora - Jigger lakes stock
9. White Otter Lake pluton
Massive felsic to intermediate plutonic rocks.
Gneissic, foliated felsic to intermediate plutonic rocks.
Paragneiss, orthogneiss and migmatitic rocks.
Metavolcanic and metasedimentary rocks.
10 km
10 miles
modified after McCrank et al, 1979

Figure 8.4. Plutonic rocks of the Ignace area.

trunka staked an area 6.5 km southeast of the Nelson property. Petrunka's property, optioned to Cold Spring Granite (Canada) Ltd., is transected by the highway and the Trans-Canada pipeline and includes a Bell Canada microwave tower site. Massive, white to grey "granite" with few fractures is exposed in several areas on the property. Another prospective area in the north part of the batholith is exposed along a new road, presently under construction, called the Twin River Road. This road leads east off the Sandy Point Road, 4 km south of Borups Corners.

The southern part of the Revell batholith is exposed along the newly opened Bending Lake Road which goes south from Highway 17, 33 km west of Ignace. The area is predominantly underlain by pink to red porphyritic granite. Overall, this granite appears to be too highly fractured and contains too many veins, pegmatite patches and inclusions to be suitable for dimension stone. However, some areas were better than others. A 1 km section of white granite was encountered 12 km south of Highway 17. This granite appeared to be less fractured than the surrounding areas and the area should be examined more closely for good stone.

Cecil Lake Pluton (Indian Lake Batholith)

The Cecil Lake pluton is an irregular-shaped granitoid body comprising fine- to medium-grained grey-white to pink granite. The town of Ignace is located in the southwestern part of the pluton. The granitic body is largely unfractured and thick sheets can be observed where exposed. The pluton has been the site of past production of granite dimension stone including the Bannerman and Horne Quarry, the Wm. Horne Granite Quarry (Butler Station Quarry) and the Gummeson prospect (*see* Storey 1986). The former Butler Station Quarry property is the site of a granite quarry recently opened by Nelson Granite (*see* Kennedy and Sherlock 1989). The former Gummeson prospect has been staked by Palin Granite Canada Ltd. The pluton is not well exposed except along lakeshores in the area where it can be seen that the granite forms very solid, unfractured ledges. The colour, however, tends to vary from white to pink and the stone is commonly streaky. The greatest challenge in locating further stone deposits in the Cecil Lake pluton will be in locating areas of homogeneous stone or consistently streaky stone which is also very marketable. One area which appears to have good potential is located north of Ignace, along the English River forest access road, 9 to 15 km north of the junction with Highway 599.

Harmon Lake Pluton (Wapakaimaski Lake Pluton)

The Harmon Lake pluton is an elongate granitoid body which trends roughly northeast. It is located approximately 120 km north-northwest of Upsala and is transected by the Graham Road. It comprises coarse-grained grey to brown porphyritic granite. It is an extremely attractive stone but will require further investigation. The granite commonly contains inclusions and veins. A few areas were observed which may contain granite sufficiently unfractured to be quarriable. One area in the eastern part of the pluton appears to represent another phase of the granite. It is less fractured, pink in colour, and finer grained than the surrounding rocks. This pluton could be a potential source of dimensional stone.

Stedman Lake Pluton

This pluton is an oval-shaped body approximately 15 by 8 km, located northwest of the town of Upsala. It is exposed along the Graham Road, just north of Highway 17. While much of the granite in the area appears to be inhomogeneous, one area approximately 1 km north on the Graham Road exhibits good potential for dimension stone. The stone is grey to pink in colour and is characterized by dark red quartz grains which give the stone a very unique appearance. The granite is exposed on a low ridge west of the road and is fairly unfractured.

Gneiss Occurrence

An area of unfractured, grey to black gneissic rock with some pink veins and layers was identified 120 km north of Highway 17 on the Graham Road. This area should be investigated further for its stone potential.

RECOMMENDATIONS FOR EXPLORATION

Northwestern Ontario has potential deposits of many industrial minerals. It is important to examine not only the quality and size of a potential deposit, but also the current market situation for a particular industrial mineral or its derivatives.

The following write-up summarizes a number of industrial minerals for which favourable market conditions have been identified and suggests possible target areas (or geological settings) for exploration.

GRANITE DIMENSION STONE

The market for dimension stone continues to grow. In northwestern Ontario, several areas present excellent opportunities for granite dimension stone exploration. Criteria for dimension stone deposits are described in Patterson et al. (1985) and Storey (1986). The Lount Lake batholith, north of Kenora, covers a vast region with good potential for granite prospecting. The area is underlain by potential deposits of red, pink, yellow and brown granite. Recent mapping and study of the Dryberry batholithic complex (Sanborn-Barrie 1987) west of Dryden may reveal further exploration targets in this area. The producing quarries near Vermilion Bay are located in the batholith. Another property on the Pine Road, south of Tustin Township, has been staked for a streaky or gneissic granite. In the Ignace area, the Revell batholith, the Harmon Lake pluton, the Stedman Lake pluton and the Cecil Lake pluton are potential sources of white and grey granite (*see* Research by Industrial Minerals Staff section of this report). In the Marathon area, much of the readily accessible prospective ground is staked. However, a number of areas that are less accessible should be explored for dark-coloured commercial granites.

DECORATIVE STONE

There is a growing market for decorative crushed stone for landscaping, and for use as aggregate in the manufacture of precast concrete panels and agglomerated stone products. The type of stone required must have distinctive, bright colours such as white, red and green. Nearly any kind of material can be used, but harder, more resistant minerals and rocks are preferred. White quartz with no inclusions or sulphides is of particular interest for this application. Potential targets are wide "unmineralized" quartz veins which may be found in many geological settings.

SANDSTONE

Sandstones of the Sibley group in the Thunder Bay–Nipigon–Schreiber area may be good potential building stone deposits, if areas can be located from which large blocks can be extracted. Sandstone which can be split along bedding into sheets 3 to 6 cm thick makes excellent flagstone. Blocks of sandstone are required in restoration work for sandstone buildings. Flagstone has a wide market for both commercial and residential applications.

AMETHYST

McTavish and MacGregor townships are still the best targets for amethyst exploration. Other areas include the Kabamichigama Lake area and the Nagunagisic Lake area.

WOLLASTONITE

Wollastonite, as well as mica, kaolin and talc, are experiencing growing markets as speciality fillers and extenders for various products including paints and plastics. Wollastonite is of interest as a replacement for asbestos. Wollastonite is associated with the Prairie Lake carbonatite complex. It has also been identified in the Pijitawabik Bay area, Lake Nipigon. These areas should be examined for sizeable concentrations of the mineral.

GRAPHITE

Graphite is currently receiving a great deal of attention because of the demand for, and resultant high price of, flake graphite. Flake graphite is used in magnesite-carbon refractory brick for steel making and in crucibles used in smelting. Crystalline flake graphite in the Archean rocks of northwestern Ontario is associated with medium- to high-grade regional metamorphic schists and gneisses. Several graphite occurrences in the Kenora area are described by Storey (in press). Flake graphite is reported to occur in the Caramat area (T. Johansen, Prospector, personal communication, 1989).

RARE EARTHS

The rare earth elements (REEs) are experiencing market growth in a couple of areas; neodymium and samarium for permanent magnets and yttrium for high-tech ceramics. The rare earths are commonly associated with alkalic, peralkalic and carbonatite igneous complexes. These complexes are targets for REE exploration in northwestern Ontario.

ZIRCON AND HIGH ALUMINA MINERALS

These minerals are growing in demand for refractory and advanced ceramic applications. Zircon is found associated with alkalic rocks in northwestern Ontario. The alumino-silicates, including andalusite, kyanite and sillimanite, are associated with aluminous metamorphic rocks. Concentrations of kyanite and sillimanite are found in the Manitouwadge area.

FLUORITE, BARITE AND CALCITE

Fluorite and barite have been identified in a recent study as minerals with potential for growth in the inorganic chemicals industry (Law et al. 1989). Fluorite and barite are found in the Thunder Bay area and along the north shore of Lake Superior, barite occurs in the Hemlo area and fluorite is associated with the Springpole Lake alkalic complex in the Red Lake area.

Calcium carbonate was also identified as a mineral with potential for growth in the chemicals industry. Calcite is commonly associated with the fluorite and barite occurrences and is commonly more abundant than either of the other minerals.

OTHER MINES AND MINERALS DIVISION ACTIVITIES

D. Conrod of the Mineral Development and Lands Branch is conducting a review of fluorite and barite in Ontario as part of COMDA-funded studies of industrial minerals used in the inorganic chemicals industry. A number of northwestern Ontario occurrences are incorporated in the study.

F.J. Kristjansson, previously with the Engineering and Terrain Geology Section of the Ontario Geological Survey, completed a study of clay in the Thunder Bay–Nipigon area.

RESEARCH BY OTHER AGENCIES

K.M. Barron, N.A. Duke and R.W. Hodder of the University of Western Ontario are studying the Springpole Lake alkalic volcanic complex under the Geoscience Research Grant Program. The complex hosts the Springpole Lake fluorite occurrence (Barron et al. 1989).

The second phase of a study examining the dimension stone potential of six Indian reserves in the Kenora area was conducted by consultant J. Hill. Large samples of granite were extracted from five sites identified in the first phase of the study. Detailed examination of these sites was also carried out. Polished samples, in some cases 12 inches by 12 inches by 3/4 inch tiles, have been prepared and physical properties (ASTM) testing has been carried out. The study was funded by the Indian Minerals East Directorate, Indian and Northern Affairs Canada; the Native Community Branch of the Ontario Ministry of Citizenship and Culture; and the five Indian bands involved, namely Rat Portage, Grassy Narrows, Islington, Wabuskang and Dalles.

SELECTED PUBLICATIONS RECEIVED

The following publications were received in 1989 and may be useful to those interested in industrial minerals. These are available for use at the Thunder Bay Mineral Resources office.

Energy Mines and Resources Canada 1988. Canadian minerals yearbook, review and outlook; Energy Mines and Resources Canada, Mineral Report No.37.

Industrial Minerals '89, Proceedings of first annual Canadian conference on markets for industrial minerals, October 17 and 18, 1989; Blendon Information Services, Willowdale, Ontario.

Plumpton, A.J., organizer. 1988. Production of high value industrial minerals and ceramic powders: seizing the opportunities for innovation; Notes on Workshop No. 6, 27th Annual Conference for Metallurgists, Canadian Institute of Mining and Metallurgy.

Shadmon, A. 1989. Stone, an introduction; The Bootstrap Press, New York, 140p.

Ministère de l'Energie et des Ressources 1989. Les minéraux industriels matériaux des années 90, 361p.

PERIODICALS

Dimensional Stone, Dimensional Stone Institute, Inc.

Industrial Minerals, Metal Bulletin Journals Ltd.

Materials Edge, Metal Bulletin Journals Ltd.

Building Stone Magazine, Building Stone Institute

REFERENCES

Ayer, J.A., Gil, K.M. and McCurdy, M. 1985. Precambrian geology of the Bigstone Bay area, southern part, Kenora District; Ontario Geological Survey, Preliminary Map P.2831, scale 1:15 840.

Barron, K.M., Duke, N.A. and Hodder, R.W. 1989. Grant 331 Petrology of the Springpole Lake alkalic volcanic complex; *in* Geoscience Research Grant Program, Summary of Research 1988-89, Ontario Geological Survey, Miscellaneous Paper 143, p.133-145.

Breaks, F.W. 1980. Lithophile mineralization in northwestern Ontario: rare element granitoid pegmatites; *in* Summary of Field Work 1980, Ontario Geological Survey, Miscellaneous Paper 96, p.5-9.

Breaks, F.W., Bond, W.D. and Stone, D. 1978. Preliminary geological synthesis of the English River Subprovince, northwestern Ontario and its bearing upon mineral exploration; Ontario Geological Survey, Miscellaneous Paper 72, 55p.

Campbell, G. 1989. Amethyst, Ontario's favorite rock is a real gem; Lake Superior Magazine, v.10, issue 6, p.46-51.

Hewitt, D.F. 1967. Pegmatite mineral resources of Ontario; Ontario Department of Mines, Industrial Mineral Report 21, 83p.

Kennedy, M.C. and Sherlock, E.J. 1988. Northwestern region industrial minerals program – 1987; *in* Report of Activities 1987, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 138, p.161-174.

——1989. Northwestern region industrial minerals program – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.157-178.

Law, Sigurdson, and Associates, and SRI International 1989. Inorganic chemicals: prospects for Ontario's industrial minerals; Ontario Ministry of Northern Development and Mines, Industrial Mineral Background Paper 11, 93p.

McCrank, G.F.O., Misiura, J.D. and Brown, P.A. 1981. Plutonic rocks in Ontario; Geological Survey of Canada, Paper 80-23, 171p.

Milne, V.G. 1962. The petrology and alteration of some spodumene pegmatites near Beardmore, Ontario; unpublished PhD thesis, University of Toronto, Toronto, 249p.

Patterson, G.C., Mason, J.K. and Schnieders, B.R. 1985. Thunder Bay Resident Geologist area, north central region; *in* Report of Activities 1984, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 122, p.56-133.

Prud'homme, M. 1987. Talc, soapstone and pyrophyllite; Canadian Minerals Yearbook 1986, Review and Outlook, Energy Mines and Resources Canada, Mineral Report 35, p.60.1-60.10.

Sage, R.P., Breaks, F.W., Stott, G.M., McWilliams, G.M. and Atkinson, S. 1974. Operation Ignace–Armstrong, Ignace–Graham sheet, districts of Thunder Bay, Kenora and Rainy River; Ontario Division of Mines, Preliminary Map P.964, scale 1:126 720.

Sanborn-Barrie, M. 1987. Geology of the Dryberry batholithic complex, District of Kenora; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.52-60.

Storey, C.C. 1986. Building and ornamental stone inventory in the districts of Kenora and Rainy River; Ontario Geological Survey, Mineral Deposits Circular 27, 168p.

——In Press. An evaluation of the industrial mineral potential of parts of the districts of Kenora and Rainy River, Open File Report.

Wilson, M.E. 1926. Talc deposits of Canada; Geological Survey of Canada, Economic Geology Series No.2, 149p.

Wong, J. and Oliver, D. 1982. Grey granite project, Ignace area; Township of Ignace Mining Sector Work Program, unpublished report.

Zeitner, J.C. 1989. Thunder Bay; Lapidary Journal, November 1989.

9. Northeastern Region Introduction

P.E. Giblin

Manager, Mineral Resources, Northeastern Region

The year was a mixed one for the exploration and mining industries in northeastern Ontario.

Exploration and development activity related to gold and silver deposits declined sharply throughout most of the region, the notable exception being the Wawa District where activity generally continued at a high level, particularly in the Mishibishu Lake area. Throughout the region there was a modest increase in exploration for base metals, particularly nickel.

A total of 61 mines and quarries were in production during all or part of the year. Principal commodities produced were gold, silver, zinc, nickel, copper, cobalt, platinum group metals, uranium, iron ore, silica, serpentine, talc, barite, limestone, dolostone, building and decorative stone.

Three new gold mines, a nickel mine, and a granite quarry began production during the year. The new gold mines were the Giant Yellowknife Mines Limited Number 5 Open Pit in Timmins; the St. Andrew Goldfields Limited mine in Stock Township east of Timmins; and the Wawa area Magnacon Mine, jointly owned by Flanagan-McAdam Resources Inc., Muscocho Explorations Limited and Windarra Minerals Limited. In the Timmins area, Timmins Nickel Inc. began production of nickel from the Redstone nickel deposit in Eldorado Township. Canadian Shield Quarries Limited commenced production of "black granite" building stone from a long-dormant quarry in Dana Township near Sudbury.

Significant announcements were made concerning development of new mines in the Levack area near Sudbury. Inco Limited announced that the company will develop a new mine, to be known as the McCreedy East Mine. Full production is to be achieved by 1996. Development continued on the company's second all-electric mine, the Lower Coleman Mine, with production scheduled to begin in 1990. Falconbridge Limited announced that the Craig orebody will be developed from the Strathcona Mine, and that production will begin in 1993.

The new mine openings were offset by several closures. The Kerr Mine (the former Kerr Addison Gold Mine) of Golden Shield Resources Limited ceased production in the Larder Lake area. Three gold mines closed in the Timmins area: the Owl Creek Open Pit Mine of Falconbridge Gold Corporation, the Aquarius Mine of Asarco Exploration Company of Canada Limited, and the Timmins Open Pit Mine of Giant Yellowknife Mines Limited. The Ross (gold) Mine at Holtyre, presently owned by Preston Electrical and Mechanical Limited, closed. Falconbridge Limited completed mining of the Falconbridge Open Pit. All mining of silver has ceased in Cobalt, with Agnico-Eagle Mines Limited closing the Beaver-Temiskaming Mine. Dofasco Inc. announced that both the Sherman Mine at Temagami and the Adams Mine at Kirkland Lake will cease production of iron ore in March 1990.

Underground development continued on several properties, notably in the Mishibishu Lake area of the Wawa District, and in the Kirkland Lake area.

There are six Resident Geologists' offices in the Northeastern Region, located in Wawa, Timmins, Kirkland Lake, Sault Ste. Marie, Sudbury and Cobalt. Drill Core Libraries are located in Timmins, Kirkland Lake and Sault Ste. Marie. During the year, staff of these facilities provided mineral exploration assistance and advice to more than 8000 visitors.

The Resident Geologists visited and reported upon exploration and development projects, and producing mines throughout the region. Information resulting from this work was used to assist the minerals industry in exploration and development work; to guide utilities, provincial and municipal governments in land-use, regional development and hazard abatement projects; and to contribute towards geoscientific projects undertaken by other government agencies and universities.

Regional staff continued studies of gold deposits in the Matachewan–Kirkland Lake–Larder Lake and Sudbury areas. A stream-sediment geochemical survey was carried out in Bayly Township near Kirkland Lake in collaboration with the Geological Survey of Canada. Geological mapping and study of mineral deposits continued in the Kabinakagami Lake area northeast of Wawa, and in Banting and Best townships near Temagami. Field investigations of potential building stones continued in the Sudbury area. In Cobalt, a project was undertaken to compile mining, geology, ore grade and production data concerning several mines that have closed in the area; the co-operation of the owner, Agnico-Eagle Mines Limited, is much appreciated. Compilation of exploration data, in the form of Geological Data Inventory Folios, continued in Sudbury, Cobalt and Wawa. Virtually all of these projects will cease in early 1990 with the termination of the five-year Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

Drill core was collected from numerous exploration sites, catalogued, and made available for examination and analytical work by industry, universities and government.

The ninth annual regional geoscience seminar was held early in the year in Timmins, with more than 300 people attending each day of the two-day meeting. The seminars are designed to bring new geoscience developments and information to the attention of the exploration industry in northeastern Ontario.

Staff also presented papers and poster sessions at the Ontario Mines and Minerals Symposium held in Toronto in December.

Resident Geologists led numerous field trips for industry, government and university participants; conducted prospectors' classes in Timmins, Kirkland Lake, Haileybury, Sudbury and White River; and spoke to school groups, service clubs, Junior Rangers, visitors to provincial parks and other groups.

An Environmental Youth Corps project was developed and supervised to improve the area surrounding past mining operations in Kirkland Lake in preparation for a possible tourist attraction. Staff continued to provide assistance and advice to the Ministry's abandoned mine hazards abatement program, particularly in the Cobalt, Bruce Mines and Kirkland Lake areas.

10. Wawa Resident Geologist's District—1989

D.J.J. Tortosa[1], E.D. Frey[2], R.C. Stewart[3], A.C. Wilson[3], W. Wing[3], P. Beach[4] and J.R. Walmsley[5]

[1]Resident Geologist, Wawa Resident Geologist's Office Northeastern Region.

[2]Staff Geologist, Wawa Resident Geologist's Office, Northeastern Region.

[3]Contract Geologist, Wawa Resident Geologist's Office, Northeastern Region.

[4]Contract Geologist, Sault Ste. Marie Resident Geologist's Office, Northeastern Region.

[5]Drill Core Library Geologist, Sault Ste. Marie Drill Core Library, Northeastern Region.

INTRODUCTION

The Wawa Resident Geologist's office continued into its third year of operation, providing exploration companies and the public with access to information on mineral resources and technical advice. It also acted as a sales outlet for claim maps, claim tags, prospector's licences, geological maps and publications. The number of visitors through the office averaged about 90 per month, a decrease of 30 percent over last year. This decline reflects the decrease in exploration activity within the Wawa District (Figure 10.1, Table 10.1), which was also characterized by a decrease in the number of active exploration programs (Figure 10.2), the number of claims recorded (Table 10.2) and in the number of active exploration companies/prospectors in the area.

Permanent office staff consists of D. Tortosa, Resident Geologist; E. Frey, Staff Geologist; and E. Leschishin, Resident Geologist's Secretary. Contract geological staff consists of L. Ashick (to the end of April 1989), P. Beach, R. Stewart, C. Lowe, A. Wilson and W. Wing. Summer contract assistants were C. Brown and T. Case, who was employed through the Experience '89 program.

Over the past year, exploration and mine development activity focussed primarily on the Mishibishu Lake, Goudreau and Michipicoten mining camps (Figure 10.1, Table 10.1). Expenditures under the Ontario Mineral Exploration Program amounted to slightly over $2 million based on total expenditures of slightly over $10 million. An increase in the number of active projects occurred in the Kabinakagami Lake and Dayohessarah Lake areas, in the northernmost part of the district. There also was a significant increase in claim staking activity immediately north of White River, along an east-trending corridor which encloses a number of metavolcanic and metasedimentary enclaves enveloped by granodiorite and tonalitic gneisses.

In the Goudreau area, the Kremzar Mine (Canamax Resources Inc.) and the Magino Mine (Muscocho Explorations Limited) continued into their second year of production. Canamax initiated underground development of the Lochalsh gold deposit, situated under Goudreau Lake, northeast of the Magino Mine and within the Goudreau Lake shear zone. The two mineralized zones have a combined drill-indicated reserve of 1.4 million tons averaging 0.2 ounce gold per ton. It is expected that the deposit will provide additional mill feed to the Kremzar mill.

In the Wawa–Michipicoten area, Citadel Gold Mines Inc. completed underground development and test mining at the Surluga Mine. Results from the test mining and milling indicate that the mine is economic at gold prices between C$450 and C$500. The mill will continue to process surface stockpiles and Citadel is actively seeking custom milling contracts.

In the Mishibishu Lake area, the Magnacon Mine (Muscocho Explorations Limited) was officially opened in June. The mine has an expected production rate of 60 000 ounces gold per year. Granges Inc. continued surface exploration and outlined several gold-bearing zones west of the Magnacon Mine. The Mishi Main Zone is being considered for possible surface and/or underground mine development.

South of Mishibishu Lake, Noranda Exploration Company, Limited, initiated underground development of the Eagle River deposit in August. Drill-indicated reserves have been estimated at 1.77 million tons at 0.25 ounce gold per ton. Noranda also outlined a significant gold prospect at the western end of the Mishibishu Lake deformation zone (MLDZ). Gold occurrences have now been identified over the full 50 km strike length of the MLDZ.

In the Renabie–Dog Lake area, exploration activity was at a significantly lower level than last year, with interest focussing on the Renabie Mine area. The Renabie gold Mine, celebrating the pouring of its millionth ounce in May 1989, continued to produce gold from below the 3400-foot level.

Algoma Steel Corporation Limited announced that production at its Algoma Ore Division in Wawa would continue until 1992, at which time it may be shut down. Development of the siderite reserves at the MacLeod Mine are to be discontinued in 1990.

Exploration, mine development and mining activity in the Wawa District continues to have a significant impact on the communities in the area (Figure 10.3). In order to assist in the regional development of the area, the Provincial Government has initiated the construction of a road link to the Goudreau area mines by way of High-

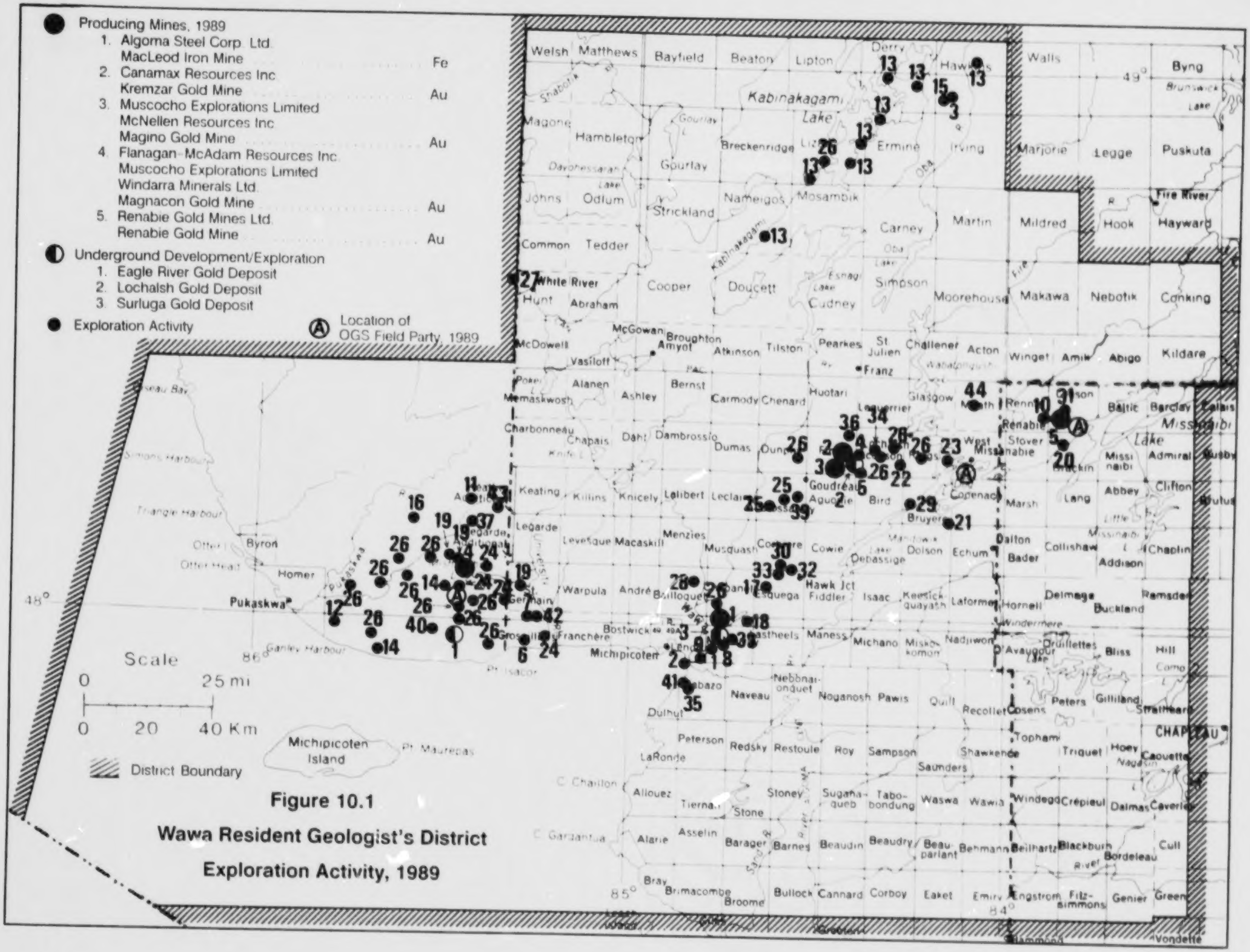

Producing Mines, 1989
1. Algoma Steel Corp. Ltd. MacLeod Iron Mine .... Fe
2. Canamax Resources Inc. Kremzar Gold Mine .... Au
3. Muscocho Explorations Limited McNellen Resources Inc. Magino Gold Mine .... Au
4. Flanagan-McAdam Resources Inc. Muscocho Explorations Limited Windarra Minerals Ltd. Magnacon Gold Mine .... Au
5. Renabie Gold Mines Ltd. Renabie Gold Mine .... Au
Underground Development/Exploration
1. Eagle River Gold Deposit
2. Lochalsh Gold Deposit
3. Surluga Gold Deposit
Exploration Activity
Ⓐ Location of OGS Field Party, 1989
Scale
0 25 mi
0 20 40 Km
District Boundary
Michipicoten Island
Kabinakagami Lake
White River
Wawa
Michipicoten
Pukaskwa
CHAPLEAU
Missinaibi Lake
48°
49°
84°
85°
86°

Figure 10.1

Wawa Resident Geologist's District

Exploration Activity, 1989

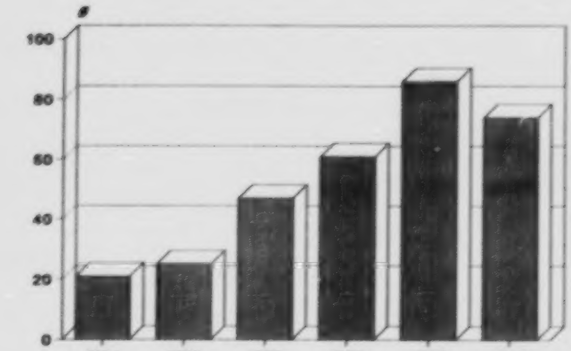
TABLE 10.1. EXPLORATION ACTIVITY DURING 1989.

Number on Figure	Individual or Company	Activity
1.	ALLIED NORTHERN RESOURCES INC.	GEOLOGY, PROSPECTING, TRENCHING
2.	ALLUVIAL GOLD MINES INC.	EXPLORATION, LINECUTTING, SAMPLING
3.	AURLOT RESOURCES LTD.	TRENCHING, DIAMOND DRILLING
4.	CANAMAX RESOURCES INC.	EXPLORATION, DIAMOND DRILLING
5.	CANLORM RESOURCES LIMITED	TRENCHING, DIAMOND DRILLING
6.	CENTRAL CRUDE LIMITED	MINERAL EXPLORATION
7.	CHARLES E. PAGE	MINERAL EXPLORATION
8.	CITADEL GOLD MINES INC.	GEOLOGY, STRIPPING, TRENCHING, DRILLING
9.	CLIFFORD CLEMENT	MINERAL EXPLORATION
10.	CONQUEST YELLOWKNIFE RESOURCES LTD.	DIAMOND DRILLING
11.	DAIWAN ENGINEERING LIMITED	MINERAL EXPLORATION
12.	DOMINION EXPLORERS INC.	PROSPECTING, MAPPING, GEOPHYSICS, TRENCHING
13.	DURHAM GEOLOGICAL SERVICES INC.	MINERAL EXPLORATION
14.	EXPLORATION SERVICES LTD.	PROSPECTING
15.	EXSICS EXPLORATION LTD.	MINERAL EXPLORATION
16.	FERDERBER GEOPHYSICS LIMITED	DIAMOND DRILLING
17.	FIRESPUR EXPLORATION LIMITED	EXPLORATION, STRIPPING, DRILLING
18.	GOLDEN POINT EXPLORATION LIMITED	STRIPPING, TRENCHING, DRILLING, SAMPLING
19.	GRANGES INCORPORATED	STRIPPING, TRENCHING, DIAMOND DRILLING
20.	HURON STAR RESOURCES LIMITED	MINERAL EXPLORATION
21.	JMS MINE CONTRACTING LTD.	MINERAL EXPLORATION
22.	KOWKASH GOLD AND TRISK MINERALS LTD.	DIAMOND DRILLING
23.	LOYDEX RESOURCES INCORPORATED	MINERAL EXPLORATION
24.	MUSCOCHO EXPLORATIONS LIMITED	GEOLOGY, PROSPECTING, TRENCHING, DRILLING
25.	MCADAM RESOURCES INCORPORATED	MINERAL EXPLORATION, DIAMOND DRILLING
26.	NORANDA EXPLORATION COMPANY LIMITED	MINERAL EXPLORATION
27.	NORGRANITE COMPANY LIMITED	LINECUTTING, GEOLOGY, PROSPECTING
28.	PLACER DOME INCORPORATED	GEOLOGY, GEOPHYSICS, DIAMOND DRILLING
29.	R.S. MIDDLETON EXPLORATION SERVICES LTD.	MINERAL EXPLORATION
30.	REED LAKE EXPLORATION LIMITED	PROSPECTING, GEOLOGY, TRENCHING, DRILLING
31.	RENABIE GOLD MINES LIMITED	STRIPPING, TRENCHING, BLASTING
32.	RON BUCHANAN	GEOPHYSICS, STRIPPING, DIAMOND DRILLING
33.	SOOCANA EXPLORATION LIMITED	GEOLOGY, GEOCHEM, PROSPECTING, DRILLING
34.	SPIRIT LAKE EXPLORATION LIMITED	STRIPPING, TRENCHING, DIAMOND DRILLING
35.	STANLEY KUSTEC	STRIPPING, TRENCHING, DIAMOND DRILLING
36.	SUDBURY GEOLOGICAL SERVICES INC.	DIAMOND DRILLING
37.	TUNDRA GOLD MINES LIMITED	MINERAL EXPLORATION, DIAMOND DRILLING
38.	VAN OLLIE EXPLORATION LIMITED	LINECUTTING, GEOPHYSICS, PROSPECTING
39.	WHITNEY PORCUPINE RESOURCES LTD.	GEOLOGICAL MAPPING, SAMPLING
40.	ONEIDA RESOURCES LIMITED	STRIPPING, GEOLOGY, DRILLING
41.	BRIDGET LAKE RESOURCES LIMITED	MINERAL EXPLORATION
42.	HSK MINERALS LIMITED	STRIPPING, GEOLOGY, PROSPECTING
43.	RISE RESOURCES INCORPORATED	MINERAL EXPLORATION
44.	SEARS, BARRY, AND ASSOCIATES LTD.	EXPLORATION, LINECUTTING, MAPPING

TABLE 10.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK FILED, 1989.

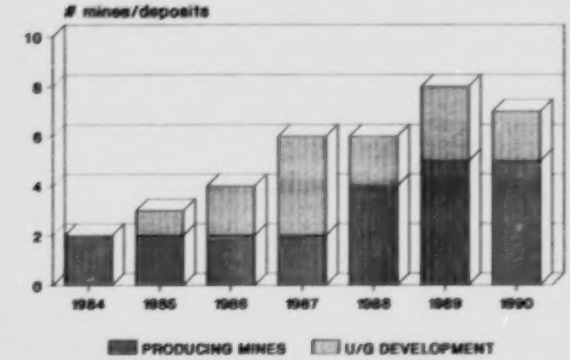
Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989[1]	1,113	3,584	15,253	67,587	158,589	59,729	335,957
1988	6,131	1,665	17,138	133,386	301,089	22,630	513,862
1987	4,880	2,030	12,172	54,720	224,756	10,349	350,321

[1] as of November 30, 1989



Source: W.R.G.O.
Updated: January, 1990

Figure 10.2. Exploration programs in the Wawa District, 1984–89.



Source: W.R.G.O.
1990: projected

Figure 10.3. Producing mines and underground exploration, 1984–89.

way 519 from Dubreuilville, with completion expected by the fall of 1990. In addition, a Regional Inter-Ministry Development Committee has been established to deal with regional development issues of concern to both the exploration and/or mining companies and the affected communities. A "Mines Impact Study" has been completed for White River and updated for Wawa and Dubreuilville to assist in community planning.

MINING ACTIVITY

Algoma Ore Division

The Algoma Ore Division of Algoma Steel Corporation continued to mine siderite iron ore at the George W. MacLeod Mine in Wawa during 1989. Production for 1989 through to the end of November was 1143728 tons of sinter from 1220000 tons of ore with an average grade of 34.6 percent iron.

Algoma Steel Corporation Limited announced that underground production, ore preparation and sintering at its Algoma Ore Division in Wawa would continue until 1992. At this time operations are to be shut down unless an alternative, limited operation proves feasible. This alternative operation would involve the recycling of "waste oxides" or "scale" from other steel plants which would be mixed with siderite, to produce a high-grade iron oxide sinter to be used in the blast furnaces in Sault Ste. Marie. Algoma Ore Division has a ten-year developed reserve at the MacLeod Mine; as such, underground development operations are to be discontinued by the first quarter of 1990. A key element to the viability of any future alternative operation will be transportation costs.

Since 1939, the Algoma Ore Division has mined 100 million gross tons of iron ore with expenditures totalling over $800 million. In 1989, the company celebrated 50 years of siderite production; the celebration included the 60th anniversary of the Ontario Provincial Mine Rescue Competitions, a historical display and audio-visual presentations.

Renabie Mine

Production at the Renabie Mine through October 1989, was 205070 tons with an average grade of 0.194 ounce gold per ton. The mill ran at an average rate of 675 tons per day. Expected production for 1989 is estimated at 234698 tons at 0.196 ounce gold per ton. Mining activity during 1989 took place on 12 levels accessed by an internal ramp and winze. The underground mining operation consists of trackless sublevel caving with the ore and waste dumped to the 4245-foot level where skips in a winze carry the ore to the 3105-foot level. Railcars transfer the ore and waste on the 3105-foot level to the main shaft for hoisting to surface. The mine and mill employ about 175 people.

During the year, mine development occurred on 12 levels, from the 3415- to the 4345-foot level. A decline was begun from the 4245- to the 4365-foot level with drill stations established to define the ore zone on the 4600- and 4700-foot levels. Underground development drilling in ore totalled 13144 feet. The total estimated proven and probable reserves are 1215493 tons at 0.212 ounce gold per ton.

The Renabie ore zone consists of large pods and lenses of quartz up to 100 feet wide and 500 feet in length, containing gold associated predominantly with pyrite. The quartz pods and lenses plunge about 60° west and form shoots within a steeply south dipping shear zone (the Renabie "break"), characterized by a red-altered, quartz-sericite schist.

Kremzar Mine

The Kremzar Mine is owned and operated by Canamax Resources Inc. Access to the orebody is with a spiral decline to the 152 m level, to be extended to reach a vertical depth of about 244 m. The sublevel retreat mining method is currently being used down to the 110 m level; shrinkage stoping is being considered for the deeper levels.

Gold production to the end of November 1989, is 22193 ounces, and is expected to reach 24200 ounces for 1989. The total gross tons mined was 157931 metric tons (to December 1989) at an average millhead grade of 4.22 grams gold per tonne (g/t). The mill is designed to operate at a capacity of 550 metric tons per day and averaged 533 metric tons per day. It uses a carbon-in-pulp extraction process for gold recovery. The mine and mill employ a total of 115 people, 32 resident on site and 83 daily commuters.

During the year, underground development encountered small (0.3 m wide) quartz veins containing very high grade gold content (1 ounce range) in a zone refered to as the "R-Zone". New development took place on levels 110 m, 125 m, 140 m, 170 m, 185 m, 200 m and 220 m. A total of 13 741 m of development drilling was completed to delineate the mineralized zone on all eight levels.

The Kremzar gold deposit consists of a series of siliceous lenses plunging about 45° west, separated by less strongly mineralized, altered host rock. The gold-bearing lenses and altered host rock form a shear zone that strikes 140° and dips 70° southwest and transects a metagabbro.

Magino Mine

The Magino Mine is jointly owned by Muscocho Explorations Limited (50%) and McNellen Resources Inc. (50%). Estimated ore reserves stand at 1.9 million tons with an average grade of 0.25 ounce gold per ton calculated from diamond drilling above 500 feet. Gold production up to November 1989, was 19707 ounces from 115242 tons of ore milled with an average head grade of 0.178 ounce gold per ton. The estimated annual production for 1989 is 24270 ounces. The mill has an operating capacity of 500 tons per day and the mine and mill employ a total of 132 employees, 93 resident on site and 39 daily commuters.

The Magino orebody is accessed by a spiral decline with levels at 100, 200, 250, 350, 400 and 500 feet below surface. Deep drilling in 1988 indicated the continuation of significant ore grades from 3 to 30 feet wide to a depth of 2000 feet, over a strike length of 2800 feet. Underground drilling for 1989 amounted to 47668 feet at 50-foot centres. Mining is taking place on four levels, using shrinkage and longhole mining methods.

Gold mineralization occurs in siliceous zones and quartz veins within sheared portions of the Webb Lake granodiorite-trondhjemite stock. The mineralized shear zones strike east and dip steeply to the north, forming part of the Goudreau Lake shear zone.

Magnacon Mine

The Magnacon Mine was officially opened June 23, 1989. It is jointly owned by Flanagan-McAdam Resources Inc. (50%), Muscocho Explorations Limited (25%) and Windarra Minerals Ltd. (25%). The gold deposit is located in the Mishibishu Lake area and has a drill-indicated gold reserve of 1.44 million tons with an average grade of 0.245 ounce gold per ton.

A spiral decline provides access to six levels within 500 feet of the surface. Extensive lateral work has been completed on the upper four levels. The higher grade portion of the deposit is currently being mined and has an estimated ore reserve of 445000 tons, grading 0.361 ounce gold per ton (Northern Ontario Business, April 10, 1989). A 30 mile long power line was constructed from Highway 17 to the mine site in order to access power from a new hydro-electric generating station at Steephill Falls.

The Magnacon Mine was in a pre-production start-up phase of its operation in 1989 and began official production on January 1, 1990. Production statistics for 1989 are not available. Forecast production for 1990 is 50000 ounces of gold from 250000 tons of ore milled.

A 600 ton per day mill was completed by the first quarter of 1989. The mill will be expandable to 800 tons per day with a possible increase to 1000 to 1200 tons per day at a later date. The mine currently has a workforce of 125, all resident on site.

A surface deep drilling program, totalling 20000 feet, was completed to test the easterly down-plunge extension of the Main Zone, and to develop more reserves in the Upper and Curtis zones. The Main Zone was intersected at an 1800-foot depth, and additional reserves were outlined in the Upper and Curtis zones.

The Magnacon Main Zone consists of a quartz vein system(s) that trends east and dips steeply north. The gold mineralization is contained within a shear zone composed of quartz-sericite-schist which forms part of the broader Mishibishu Lake deformation zone (Heather 1986). Gold occurs freely in association with arsenopyrite, pyrite, galena and other minor sulphides, and is particularly concentrated along the edges of the quartz veins.

ADVANCED EXPLORATION AND DEVELOPMENT

Citadel Gold Mines Inc.

During 1989, Citadel Gold Mines Inc. continued underground operations at the Surluga Gold Mine to sample and to assess the quality and mineability of ore reserves in the Jubilee shear zone. Underground operations were terminated at the beginning of September. This work established better criteria for defining mineable ore, and recalculation of reserves is in progress using these criteria.

The Citadel mill was operated as a test milling facility from April 14 to the end of November when it was shut down. To the end of October 1989, the mill processed 57956 tons of ore and development muck at an estimated head grade of 0.1053 troy ounce gold per short ton. Bullion recovery to October 31 was 4737 ounces. Additional bullion recovery is expected from November operations and clean-up. Ore processed in 1989 included significant quantities of develpment muck from operations in 1969, 1970, 1974, 1987, 1988 and 1989, as well as samples from waste piles at the Parkhill and Darwin mines.

Underground development in 1989 consisted of 2363 feet of track drift, 2111 feet of trackless ramp and 1032 feet of raises. Most of this development work was completed on the fourth to sixth levels. Extensions of the fifth level reached and sampled the Old Tom's Zone which appears to be the downplunge extension of the zone mined between 1927 and 1939 from the Jubilee Mine. Drifting on the fourth level established the presence of two separate mineralized zones in overlapping but separate segments of the Jubilee shear zone. Connections to the Jubilee Mine from the third level were completed for ventilation and drainage purposes.

Surface diamond drilling in 1989 tested the downdip extension of the Jubilee shear zone below the Surluga Mine (11 holes totalling 13842 feet), the Ganley vein (14 holes totalling 2300 feet), and the Root vein (25 holes totalling 5380 feet). Underground drilling totalled 8870 feet in 58 holes. Total diamond drilling was 30392 feet of core in 108 holes.

Management indicates that if a deep drilling program in 1990 is successful in outlining additional economic reserves, and the price of gold approaches C$500, the mine could become a viable operation. Citadel plans to provide a local service as a custom mill. In addition, an on-site assay lab is currently processing samples from other operators in the region.

Canamax Resources Inc.

Canamax Resources Inc. initiated underground development on its Lochalsh Deposit located about 2 km south of the Kremzar Mine, in the southwestern end of Goudreau Lake, on property which is wholly owned by Canamax Resources Inc. The deposit consists of two mineralized zones (Lochalsh and Island zones) which have a combined drill-indicated reserves of 1.4 million tons with an average cut grade of 0.2 ounce gold per ton.

A portal was collared in the spring of 1989 which will access the deposit using a 950 m decline, followed by southwest drifting along the two mineralized zones. The mineralized zones are thought to be similar to those at the Magino Mine which is located farther southwest on the same structural trend.

A second area of gold mineralization (Goudreau Zone), farther to the east along Goudreau Lake, is on property which is jointly owned by Canamax (51%) and Algoma Steel Corporation Limited (49%). Drilling in this area has identified a zone of gold mineralization with a strike length of about 250 m. During 1989, Canamax completed 18 diamond-drill holes for a total of 4500 m of delineation and exploration drilling. Ore reserve figures for the Goudreau Zone are not available.

Gold mineralization at the Lochalsh Deposit occurs in quartz veins and siliceous sections contained within quartz-sericite schists which form part of the Goudreau Lake shear zone. The Goudreau Lake shear zone also hosts the Magino gold deposit (Muscocho Explorations Limited) located several kilometres to the southwest. The main controlling structure (the Goudreau Lake shear zone) forms part of the broader Goudreau Lake deformation zone (Heather and Arias 1987) which contains many of the gold occurrences and past producers of the area.

Granges Inc.

Granges Inc. continued to evaluate the open pit potential of the Mishi Main Zone, completing a closely spaced 146-hole percussion drill program. The drill program was designed to provide more comprehensive data for a further review of reserves and grade. Open pit reserves in the No. 2 lens (Mishi Main Zone) now stand at 751000 tons at a grade of 0.125 ounce gold per ton (The Northern Miner, July 3, 1989). Underground reserves in the No. 4, 6, 8 and 10 lens were recalculated at 565000 tons grading 0.221 ounce gold per ton. Earlier reserve estimates were 1.1 million tons at 0.17 ounce gold per ton, with open pit reserves at 760000 tons grading 0.098 ounce gold per ton. Granges Inc. initiated an engineering study for the selection of a tailings disposal site. A decision on an underground and/or open pit operation is still pending.

Gold mineralization in the Mishi Main Zone occurs in grey quartz veins and silicified zones contained within a quartz-sericite-chlorite mylonitic schist. The gold is associated with minor pyrite. Numerous quartz veins and veinlets occur over a 3 to 5 m width and constitute the mineralized zone. The Main Zone lies about 2 km west of, and on-strike with, the Magnacon gold deposit, and is contained within a similar geological package as the Mishibishu Lake deformation zone (Heather 1986).

Hemlo Gold Mines Inc.–Central Crude Limited

Noranda Exploration Company, Limited, completed a surface drilling program at the beginning of 1989 establishing a drill-indicated reserve estimated at 1.77 million tons grading 0.25 ounce gold per ton (cut to 1 ounce). Uncut grades average 0.51 ounce gold per ton The deposit has been drilled on strike for 6400 feet, and to a depth of 1700 feet (George Cross News Letter, May 15, 1989). Bulk samples were taken from the No. 8 and Bruce zones and indicated higher grades than those estimated by diamond drilling. It remains to be determined whether, in fact, there is a significant upgrading effect similar to that found at the Magnacon Mine.

A portal collared at the Eagle River deposit in mid-summer intersected the No. 8 mineralized zone on the 4900- and 4880-foot levels (264 and 330 feet below surface, respectively). Horizontal drifting to the end of October totalled 781 feet on the 4900-foot level and 1323 feet on the 4880-foot level, on the No. 8 vein both east and west of the ramp (The Northern Miner, October 30, 1989).

The vein structure is continuous along its length on both levels, with the vein exceeding the average drift width of 12.5 feet most of the way. The zone is about 23 to 26 feet wide at the point of intersection at both levels, and contains quartz veins up to 10 feet wide along with "stockwork" quartz veins ranging from 50 to 80 percent quartz (The Northern Miner, September 18, 1989). Chip samples have averaged 0.19 and 0.14 ounce gold per ton (cut to one ounce) on each level, respectively. The second phase of the underground program will involve test stoping and removal of 40000 tons of ore to be shipped to the mill at Hemlo Gold Mines' Golden Giant Mine.

Gold mineralization occurs in large quartz veins contained within an east-striking, north-dipping shear zone (quartz-feldspar-sericite-chlorite schist) which cuts a diorite intrusive. The gold occurs in native form associated with minor sulphides along sericitic and chloritic partings. The ore is characterized by a pronounced "nugget effect" which makes ore reserve calculation difficult. Several mineralized quartz "pods" have been identified: No. 7, No. 8 and the Bruce vein. The No. 8 represents two pods of quartz from less than 5 to 10 m wide plunging steeply to the east over a length of about 350 m. The Bruce vein represents a single pod of similar size. The vein systems appear to be distributed *en échelon* and overlapping.

EXPLORATION ACTIVITY

MISHIBISHU LAKE AREA

On the Muscocho Explorations Limited joint venture property east of the Magnacon Mine, a surface program consisting of 34 drill holes was completed to test three previously known occurrences (the Discovery, Hollinger and Northwest occurrences), and two newly discovered zones (the East Vein and the Southeast showing). Drilling of the Discovery gold occurrence was not able to trace the vein below 200 feet. The vein system is thought to be characterized by a "pinch and swell" structural style.

Overburden stripping on the Amichi showing exposed a gold-bearing quartz vein of variable thickness, ranging from less than 1 foot up to 3 feet, contained within strongly deformed metasedimentary rocks (turbidites). Systematic mapping and sampling of the vein were completed during the summer.

A recently discovered zone referred to as the East Vein has been exposed east of the Discovery occurrence, but apparently has limited continuity along strike and downdip. The Hollinger gold occurrence was stripped late last summer exposing mineralized quartz pods up to 80 feet in length. Follow-up drilling failed to outline depth potential.

Mishibishu Resources Ltd. (the Windarra Group of Companies) completed a preliminary drill program on their property 11 km west of the Magnacon Mine, testing several surface showings and soil gold anomalies. The results were encouraging. The western extension of the favourable Mishibishu Lake deformation zone passes through the property, and measures 1300 to 2000 feet in width, and can be traced for 22000 feet along strike.

Mishibishu Resources Ltd. also acquired an option to earn a 49 percent interest in the Loon Lake property on the southwestern end of the Mishibishu Lake greenstone belt. Preliminary exploration in the area located several widely spaced mineralized areas containing significant copper-zinc and lead-zinc mineralization. There are large breccia zones and a northwest striking dike swarm in the area, suggesting that the base metal mineralization may be related to Keweenawan tectonic and volcanic activity.

Noranda Exploration Company, Limited, initiated exploration on five major properties in the Mishibishu Lake area. Initial exploration included line cutting, prospecting, sampling, reconnaissance geological mapping and geophysical surveys. A significant gold discovery, the Champagne Lake Gold Occurrence, was made about 20 km west of the Magnacon Mine within the western extension of the Mishibishu Lake deformation zone. Chip samples over a 1150-foot strike length averaged 0.48 ounce gold across 3.8 feet. Gold mineralization occurs in quartz veins and zones of silicification which are continuous but poorly exposed over a strike length of 2950 feet (The Northern Miner, July 3, 1989). The mineralized vein strikes east, dips steeply north and is contained predominantly within highly strained polymictic conglomerates within the Mishibishu Lake deformation zone.

Noranda discovered a new zone "Falcon Creek", situated about four miles east of the No. 8 zone on the Eagle River property. Grab samples yielded up to 0.59 ounce gold per ton. The zone consists of a 13- to 20-foot wide area of quartz and carbonate stringers with 3 percent sulphides, traceable for 1300 feet along strike. A high-grade discovery called the Hilltop Vein was made 1.5 miles northeast of the No. 8 zone. Grab samples of up to 5.37 ounces gold per ton were taken from a 5- to 7-foot wide quartz vein (The Northern Miner, August 28, 1989).

Granges Inc. continued overburden stripping, geological mapping and sampling of gold occurrences west of the Mishi Main Zone. Gold discoveries last year included the Granges Glory, White Swan and the KK Zone. In 1989, several additional gold occurrences were uncovered between these earlier discoveries. One new potential gold-bearing zone yielded grab samples assaying as high as 6.14 ounces gold per ton. The mineralized zone is on the extension of the Granges Glory gold occurrence and is referred to as the MM Zone. Mineralized samples ranging from 0.146 to 0.319 ounce gold per ton were taken over an 80 m strike length. Exploration on the eastern portion of their large property holdings also resulted in uncovering a significant mineralized zone east of the Muscocho property.

Many of the gold occurrences consist of what the company refers to as "crab" veins due to the presence of a thick core of quartz with quartz vein appendages which are distributed both parallel and crosscutting the rock fabric. The quartz veins are characterized by a white quartz core surrounded by a grey quartz envelope. Other gold occurrences such as the KK Zone are characterized by intense silicification of the host rock with an associated increase in disseminated sulphides. All the gold occurrences are found within highly strained rocks of the Mishibishu Lake deformation zone which straddles a major metavolcanic-metasedimentary contact.

Oneida Resources Inc. completed an exploration program on their Maple Lake property situated immediately west of the Central Crude–Hemlo Gold property. The company outlined several significant mineralized zones. Overburden stripping, geological mapping, sampling and preliminary diamond drilling were completed on the gold-bearing zones. The mineralized zones occur on the western extension of the Eagle River deformation zone which hosts the Eagle River deposit.

HSK Minerals Limited reported a number of gold discoveries on its Denison Lake property southeast of Mishibishu Lake. An exploration program consisting of prospecting, geological mapping and soil sampling identified approximately 300 quartz veins ranging from 0.5 to 12.5 feet. Forty of these veins have anomalous gold values in excess of 0.015 ounce gold per ton (The Northern Miner, September 18, 1989). One sample assayed 0.78 ounce gold per ton. Additional exploration will consist of stripping, trenching and sampling followed by diamond drilling.

Corona Corporation is continuing a regional exploration program on Algoma Central Railway land west of Highway 17. Gold-bearing quartz veins have been identified in the Iron Lake area which occur within the Iron Lake deformation zone. This zone of high strain has similarities to other high strain zones in the Mishibishu Lake area to the south. Several targets areas have been selected where they plan to follow-up with line cutting, geophysics and diamond drilling during the winter.

WAWA–MICHIPICOTEN AREA

Citadel Gold Mines Inc. completed 25 surface drill holes to test the Root vein in the northern part of the property. Results indicated that the exposed quartz veins on surface apparently do not have depth continuation past 100 feet, although significant intersections of the vein were encountered above that level.

Citadel tested the Cooper–Ganley vein system by surface drilling to a depth of 400 feet. Nine drill holes returned significant assays, five containing visible gold. Work last year indicated an average grade of 0.39 ounce gold per ton over 3.2 feet. Citadel was considering the Ganley Vein as a low tonnage open pit operation to provide additional mill feed (George Cross News Letter, May 5, 1989). Historical production from this area is estimated to have been 40000 tons grading 0.35 ounce gold per ton.

Van Ollie Explorations Limited has completed an initial exploration program on the Sunrise and Mickelson occurrences east of the Minto Mine (owned by Citadel Gold Mines Inc.). The company completed a stripping, sampling and mapping program on the Captain and Smith veins which occur just east of the Parkhill Mine (Citadel Gold Mines). During late summer, the company dewatered and sampled the Sunrise shaft (past producer), and initiated a surface diamond drilling program on the Sunrise and Mickelson surface showings, following up on overburden stripping and sampling completed during the summer. Two drill intersections of the Smith vein indicated 7 feet grading 0.914 ounce gold per ton (The Northern Miner, October 20, 1989), in addition, several significant channel samples (10.9 feet grading 0.33 ounce gold per ton). Trenching has also been completed along the Captain and Road veins which occur in the area near the Parkhill Mine. The company's objective is to try to develop enough reserves to be able to custom mill at the nearby Citadel mill. The company's property holdings are second in size only to those of Citadel Gold Mines Inc.

Noranda Exploration Company, Limited, completed a diamond-drill program on their Mink Lake gold property in Chabanel Township.

Placer Dome Inc. completed geological and geophysical surveys followed by diamond drilling on their property near Black Trout Lake in Bailloquet Township.

GOUDREAU–LOCHALSH AREA

Cline Development Corporation and Transgold Resources Inc. have an option on the Markes property, east of the old Cline Mine (past producer). Esso Minerals Canada, the previous operator, estimated a drill-indicated reserve of 72000 tons grading 0.167 ounce gold per ton (The Northern Miner, March 13, 1989).

Spirit Lake Explorations Limited completed 49 drill holes (29500 feet) in the vicinity of the old Edwards Mine in 1988, including a stripping program in the fall of 1988. Two mineralized zones (the Spirit and Edwards), were identified along with two additional targets, referred to as the Shaynee and the Cline extension. A preliminary drill-indicated reserve figure on the property was estimated at 190288 tons grading 0.35 ounce gold per ton (The Northern Miner, March 20, 1989). The Spirit Zone lies 500 feet south-southwest of the Edwards shaft and contains an auriferous quartz vein up to 120 feet long, that strikes about 120° and dips 50° to 60° north. The Spirit and Edwards zones occur immediately east of the Kremzar Mine.

Surface stripping of the "Edwards Zone" in 1988 indicated the presence of a 1 to 2 m wide discontinuous shear zone containing quartz veins and silicified sections. The shear transects a mafic volcanic unit, and consists of chlorite ± biotite schist, not unlike that which hosts mineralization at the Kremzar Mine to the west.

Infill drilling was completed on the Spirit Zone during the year, including a 5000-foot drill program initiated in the fall of 1989. The objective is to determine the extent and continuity of the Spirit Zone. Earlier drilling intersected ore-grade intersections, including 24 feet averaging 1.48 ounces of gold per ton (Northern Miner November 20, 1989).

Noranda Exploration Company, Limited, plans to initiate a trenching and diamond-drill program south of Brothers Lake in Riggs Township, and to resume their diamond drilling, stripping and trenching program on the Cline Lake property. Noranda also plans to carry out geological and geophysical surveys followed by trenching on a property east of the Markes occurrence.

Noranda Exploration Company, Limited, is completing a diamond-drill program on the Cline Lake property. Drill hole intercepts are designed to intersect undefined portions of the Cline Mine. This summer, Noranda discontinued exploration in the Lake Zone and have been focussing on other prospective areas around the Cline Mine.

Corona Corporation is continuing a regional exploration program on Algoma Central Railway land covering 13.5 townships. Initial prospecting in the area east of Highway 17 has uncovered several areas worthy of detailed follow up. Two areas of interest are the Cradle Lake area and the Big Foot Lake area. They plan to carry out line cutting, geophysics and diamond drilling during the winter.

MISSANABIE-RENABIE AREA

Renabie Mines Limited initiated an exploration program north and south of the mine site, consisting of bedrock stripping, washing, trenching and sampling on the "C" Zone and Frontenac Vein. The company hopes to develop these mineralized zones as additional mill feed.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

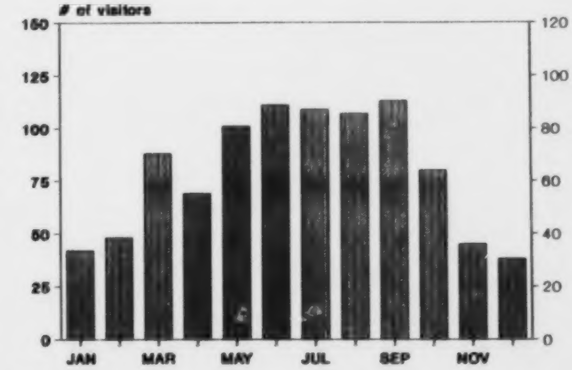
The Resident Geologist spent 75 percent of his time involved in activities related to the administration and management of the Wawa office and five Northern Development Fund projects; the remaining time was spent on field-related activities. The projects sponsored by the Northern Development Fund are part of the Wawa Economic Development Initiatives, set up to provide support for the increased exploration and mining activity in the area, and because of the need for the communities to diversify their industrial base.

Public addresses concerning exploration and development activity in the Wawa area were presented at a Prospectors and Developers Meeting in Sault Ste. Marie, at a CIM meeting in Thunder Bay, at a Wawa Rotary Club meeting and at the annual Geoscience Seminar in Timmins. The Resident Geologist also was a guest speaker at a meeting of the Canadian Electrical Association, Hydraulic Engineering Section, sponsored by Great Lakes Power Limited.

The Resident Geologist was a member of a Project Steering Committee that was responsible for a Mines Impact and Opportunities Study carried out for the Township of White River by the Coopers and Lybrand Consulting Group. The Resident Geologist continued to be a member of, and provided technical support to, a Regional Inter-Ministry Development Committee for the Wawa District (Wawa Region Working Group). Two reports were submitted to the committee in response to a request for additional information on mine development impacts in the Wawa District, and an outline of the permits required at various stages of the mining sequence. The Resident Geologist also was a member of the Mishibishu Lake Area Committee, involved in assisting companies at the advanced exploration stage with obtaining permits and other administrative requirements. The Resident Geologist chaired the provincial Mineral Potential/Mining Impact Task Group, created to develop guidelines and recommendations for the development of mineral potential and mining impact maps for Resident Geologists' districts. The Resident Geologist was a member of the Resident Geologist Working Group, a provincial ad hoc committee, involved in a review of the role and place of the Resident Geologist within the Mines and Minerals Division.

The number of visitors to the Wawa Resident Geologist's office decreased by 30 percent during 1989 compared to 1988 (Figure 10.4). This decline was a result of the general decrease in exploration activity in the area during 1989. B. Leschishin provided the Resident Geologist with capable administrative assistance and client service support throughout the year, and co-operated with Sault College, Wawa Campus, in their Systems Operation job training program. In addition, she completed a French Language training course, through Contact North and Cambrian College, Sudbury.

The primary activities of the Staff Geologist consisted of providing information and technical advice on request to prospectors and geologists from the exploration, academic and government communities, and to the general public. The Staff Geologist responded to 451 geoservice requests, conducted 18 organized and impromptu field trips and visited 6 exploration and/or mining projects. These activities are 27 percent fewer than those of last year. Major education programs, developed and conducted jointly with A.C. Wilson, were a 20-hour public prospectors course and an introduction of geolog-



Source: W.R.G.O.
Updated: January, 1990

Figure 10.4. Client services—number of visitors, 1989.

ical teaching resources to local elementary school teachers. He also promoted geological education and mineral exploration awareness in the community with a presentation to Ministry of Natural Resources Junior Rangers and by conducting field trips for provincial park interpretative staff, elementary school teachers, a Grade 11 high school geology class and several university field courses. Most of these programs were conducted jointly with A.C. Wilson.

R.C. Stewart and the Staff Geologist continued to improve and expand the computer data base of mineral deposits in the Wawa District. They exhibited a poster on the Wawa District Mineral Deposits Database at the Regional Geoscience Seminar in Timmins and at the Ontario Mines and Minerals Symposium in Toronto.

Other activities of the Staff Geologist included serving on the Wawa District Tourism Advisory Committee, evaluating Ministry of Natural Resources lake development cottage plans for mineral exploration conflicts, promoting the new MNDM exploration assistance programs and acting in the absence of the Resident Geologist.

A.C. Wilson continued her investigation of the Kabinakagami Lake greenstone belt by extending reconnaissance mapping eastward into Hawkins Township during the 1989 field season. Time was also spent examining the Dayohessarah Lake greenstone enclave (north of White River), and in evaluating the granitic terrain in the Missanabie area. C. Brown, University of New Brunswick, provided exceptional assistance during the field season. A poster entitled "Mapping in the Wawa Area—An Update", covering the 1988 field season, was displayed at the Regional Geoscience Seminar in February. An oral presentation and poster on the "Geology and Exploration Potential of the Kabinakagami Lake Greenstone Belt" was presented at the annual Ontario Mines and Minerals Symposium in Toronto.

In addition, local field trips were conducted for a Grade One class, a local Girl Guide company, for provincial park interpretive staff and for a geology class from Lake Superior State University. A visit also was made to the Wawa Co-operative Nursery School. A series of geological "rock walks" was held at Lake Superior Provincial Park, during the summer. Evening programs on a variety of geological topics also were presented to the general public at Lake Superior and White Lake provincial parks. A.C. Wilson and the Staff Geologist jointly made a presentation on the educational resources available at the Wawa Resident Geologist's office, to the elementary school teachers at Sir James Dunn Public School in Wawa. They also jointly developed and presented a 20-hour prospecting course in White River.

W. Wing supervised the updating of Geological Data Inventory Folios (GDIFs) of the Mishibishu Lake greenstone belt that was done by C. Lowe, and personally compiled and updated other folios of the area. Exploration data submitted to the Resident Geologist's office (i.e., assessment files, work reports, OMEP reports etc.) were processed by C. Lowe and W. Wing. These GDIF data were entered into a computer data base by C. Lowe under the supervision of W. Wing. Arrangements for the microfiching of Algoma Central Railway files were made by W. Wing, completing the final stage of the Algoma Central Railway assessment file consolidation project. Algoma Ore Division exploration data were examined as part of a plan to eventually process the data in the same manner as the Algoma Central Railway files.

W. Wing and C. Lowe produced posters highlighting the GDIF program and its application to the Mishibishu greenstone belt, which were presented at the Regional Geoscience Seminar in Timmins and the Ontario Mines and Minerals Symposium in Toronto. In addition, they provided assistance to prospectors, geologists, government staff and the general public visiting the office. They also staffed the office sales counter in the absence of the Resident Geologist's Secretary. C. Lowe provided field assistance to G. Jones during an aggregate resources study in the Mishibishu Lake area. W. Wing completed a Title Searching course held by the Mining Lands Section in an effort to broaden the services available at the Resident Geologist's office.

P. Beach continued to develop and implement computer applications for the Wawa Resident Geologist's office and completed work on two mineral development related projects: a mine impact report and accompanying maps, and a listing of Government Acts and Permits Applicable to the Mining Sequence (*see* section on Research by Resident Geologist's Staff). He also assistec the Resident Geologist in the evaluation of requirements and acquisition of computer software, hardware and peripheral equipment for the Wawa Resident Geologist's office.

P. Beach also attended several courses and seminars dealing with computer-aided drafting (CAD®), Geographic Information Systems (GIS), programming and software engineering. Several demonstrations concerning computer applications within the Wawa Resident Geologist's office were presented. These included: presentations to geology classes from Lake Superior State University, Sir Sanford Fleming College and M.J. Dacey Public School, as well as, the upper management of the Sault Ste. Marie Fire Deparment, Sault Ste. Marie City Planning personnel and a number of MNDM personnel. A poster display entitled "Computer Applications in the Wawa Resident Geologist's Office" was exhibited at the annual Ontario Mines and Minerals Symposium in Toronto.

PROPERTY EXAMINATIONS

Conboy Lake Zinc-Silver Prospect

The Conboy Lake occurrence is in north-central Rennie Township, about 300 m south of the southwest arm of Conboy Lake. It is accessible by float-equipped aircraft or by a logging road from Dubreuilville that passes the north shore of Conboy Lake. The occurrence has received intermittent prospecting since its discovery in

1939. The property has been dormant since a program of stripping, trenching, geological, geochemical, geophysical surveys and diamond drilling was completed by Westfield Minerals Ltd. in 1984.

Mineralization is confined to a zone of sheared quartz-eye tuff (possibly a quartz-eye porphyry). The 3 to 5 mm diameter quartz eyes are abundant (>70%) both within and external to the shear zone. The host rock also contains elongated mafic fragments that are characterized by 1 to 2 mm pink polycrystalline garnet. The absence of garnet outside of the shear zone suggests that the shearing and the mineralization are post peak metamorphism. Cherty, laminated and massive rhyolite are abundant north of the tuff (porphyry?). Undeformed quartz porphyry dikes, up to 2 m wide, of variable orientation commonly crosscut the area.

The metamorphic grade is amphibolite to upper greenschist. Sericite and silicification within the shear zone are the dominant forms of alteration.

Sulphide mineralization is exposed over a distance of 100 m in a gossan up to 4 m wide. Abundant pyrite surrounds lenses and pods (deformed lenses) of sphalerite that range from 1 cm wide stringers to 0.5 m wide pods. The sphalerite is medium to coarse grained and black, "blackjack". Pyrite is fine to medium grained and occurs disseminated and as veinlets parallel to foliation. Minor amounts of galena occur as small clots of fine- to very coarse euhedral crystals adjacent to sphalerite pods. Chalcopyrite occurs disseminated in very minor quantities. Fine-grained quartz occurs as clots and narrow veins.

The local area foliation strikes 140° and dips 70° southwest. A shear zone transects the foliation with two prominant schistosities, one strikes 110° and dips 80° southwest; it is cut by a second schistosity of 100° strike and vertical dip. An intersection lineation plunges 70° west; a large sphalerite pod (0.5 m thick) also has the same orientation.

Assays obtained from drilling yielded up to 26.3 percent zinc, 30.6 ounces silver per ton, 5.1 percent lead, 0.18 percent copper and 0.09 ounce gold per ton over widths of 2 to 3 feet. Ore reserves to a depth of 450 feet have been estimated at 74000 tons of "higher grade material" over a width of 4.5 feet and 344000 tons of "lower grade" ore over a width of 20 feet (Assessment Files, Wawa Resident Geologist's office).

Langdon Showing

The Langdon showing is located in north-central Hawkins Township, on the north shore of Langdon Lake, approximately 150 m west of the Algoma Central Railway (ACR) tracks (*see* Figure 10.5).

Information about the property in the assessment files is insufficient. Gold was discovered by Shenango Gold Mines during the period 1925–1939, when a limited exploration program of trenching, prospecting and drilling was carried out. Additional drilling and prospecting, by Hollinger Exploration Co. Limited, is reported to have occurred in the vicinity of the showing in 1935.

No exploration activity specific to the property was recorded until 1980 when mechanical clearing of the old trenches and pits was carried out by A. McDonnell (local prospector). More recently, Falconbridge Limited carried out an IP survey, soil and rock geochemical survey and limited drilling on the property. Assay values from rock geochemistry indicate that anomalous gold

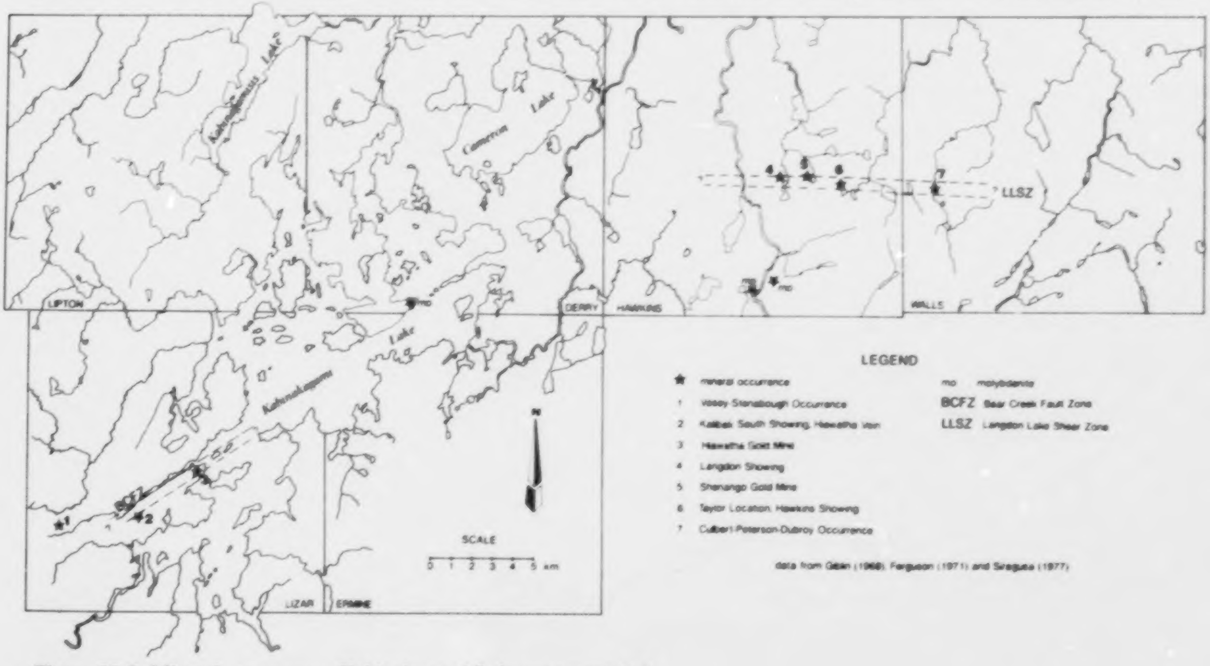

Kabinakagami Lake
Cameron Lake
LLSZ
BCFZ
mo
LIPTON
DERRY
HAWKINS
WALLS
LIZAR
ERMINE
N
SCALE
0 1 2 3 4 5 km
LEGEND
★ mineral occurrence
1 Vasey-Stenabough Occurrence
2 Kabbas South Showing, Hiawatha Vein
3 Hiawatha Gold Mine
4 Langdon Showing
5 Shenango Gold Mine
6 Taylor Location, Hawkins Showing
7 Culbert-Peterson-Dubroy Occurrence
mo molybdenite
BCFZ Bear Creek Fault Zone
LLSZ Langdon Lake Shear Zone
data from Giblin (1968), Ferguson (1971) and Siragusa (1977)

Figure 10.5. Mineral occurrences, Kabinakagami Lake greenstone belt.

values (>200 ppb Au) have been obtained from the property (Assessment Files, Wawa Resident Geologist's office).

Outcrop exposure on the property is sparse and consists of strongly foliated mafic metavolcanic rocks with narrow felsic interbeds, in contact with a felsic tuffaceous unit. Investigation of the muck piles associated with the shafts and pits indicates the mafic metavolcanic rocks may represent a sequence of strongly sheared tuffs. Sulphide mineralization (pyrite) and associated gold occurs adjacent to narrow quartz veins within the mafic metavolcanic rocks.

The gold mineralization appears to be spatially related to the mafic-felsic metavolcanic contact. This contact strikes at 80° and dips vertically. Overall strike lengths of over 100 m have been estimated for the anomalous auriferous zones (Assessment Files, Wawa Resident Geologist's office). Carbonate, as the dominant alteration product, shows a significant increase towards the centre of the mineralized zone. The presence of epidote, however, appears to indicate gold depletion.

Shenango Gold Mine

Shenango Gold Mine lies approximately 1.0 km east of the Langdon showing and occupies the eastward extension of the same stratigraphic horizon (*see* Figure 10.5). The occurrence consists of the Shenango No. 1 and Shenango No. 2 shafts, some overgrown exploration pits and shallow trenches.

Gold was discovered on the property in 1935 by Shenango Gold Mines Limited, and an exploration shaft was excavated. Trenching and drilling by Shenango Gold Mines Limited indicated favourable reserves of ore and small-scale mining commenced in 1936 and continued until 1941. Total production from the gold mine was 30 ounces gold and 32 ounces silver from 2400 tons milled. A clean up of the mill in 1945 yielded an additional 32.877 ounces gold and 5 ounces silver (Giblin 1968). Prior to the closure of the mine, Shenango Gold Mines Limited estimated overall drill-indicated reserves of 41600 tons of 0.14 ounce gold per ton (Assessment Files, Wawa Resident Geologist's office).

More recent exploration activity has consisted of ground geophysics, geological mapping, soil and rock geochemistry and drilling. Grab samples have yielded encouraging assay values of up to 52.11 g/t gold (Assessment Files, Wawa Resident Geologist's office).

Outcrop in the immediate vicinity of the two shafts is restricted to some narrow stripped areas. The main mineralized zone appears to be at the northernmost contact of a 20 to 25 m wide unit of strongly foliated felsic tuffaceous rocks which contain 5 to 7 percent disseminated sulphides. To the north of the mine site, strongly foliated mafic metavolcanic rocks (amphibolites) dominate the geology. Interbedded within these rocks are narrow (< 1 m wide) bands of light grey felsic tuffs. All units are crosscut by a 10 m wide northeast-trending diabase dike.

The gold mineralization is concentrated along the sheared contact between the amphibolites and the felsic tuffaceous rocks. This contact trends approximately 110° and dips very steeply to the north. The contact is characterized by the presence of disseminated pyrite, chalcopyrite and minor hematite. Auriferous zones have been reported to have a strike length of 150 to 250 m (Assessment Files, Wawa Resident Geologist's office).

Taylor Showing

The strongly sheared mafic and felsic metavolcanic belt described in the two previous property examinations, also hosts the Taylor showing (also referred to as the Hawkins showing). The Taylor showing occurs 2.8 km east of the Shenango Gold Mine, and occupies the eastward extension of the same shear zone (*see* Figure 10.5).

An attempt was made, during the course of the 1989 field season, to locate the Taylor showing but, due to the nature of the topography and the heavy overgrowth that has occurred since 1979 (the last year a trenching and stripping program was undertaken), the occurrence could not be located. The information that is presented here, therefore, is a summary of material available from the assessment files (Wawa Resident Geologist's office).

G. Taylor made the original discovery on the property in 1923, and carried out an extensive trenching and stripping program until 1929. Exploration on the showing has occurred intermittently until 1986, when Falconbridge Limited completed a major drilling program.

Assay results from the property have been anomalous. Values obtained from quartz veins reportedly ran 30.5 grams gold per ton over 0.3 m and 23.3 g/t gold over 6.1 m. Anomalous gold values also have been recorded in the felsic tuffaceous rocks which host the showing.

Outcrop exposure in the area is extremely sparse, but the geology is reported to be similar to that described in the previous property examinations. A series of seven auriferous quartz veins, striking parallel to the regional trend, have been described at the sheared contact betwen the felsic tuffs and the mafic metavolcanic rocks. The veins are mineralized with visible gold, pyrite, chalcopyrite and galena, and reportedly range in width from 1 to 2 feet. These veins have a strike length of up to 230 feet (Assessement Files, Wawa Resident Geologist's office).

Structurally, the regional foliations strike 90° and dip steeply (80° to 87°) to the north (Assessment Files, Wawa Resident Geologist's office). The contact between the two rock types is locally sheared along the same orientation.

RESEARCH BY RESIDENT GEOLOGIST'S STAFF

WAWA DISTRICT MINERAL DEPOSITS DATABASE

by R.C. Stewart and E.D. Frey

The Wawa District Mineral Deposits Database project continued with a third year of refinement and upgrading. The project objective is to develop and maintain a data base of facts on the geology, production and location of the numerous gold, base metal, and other mineral commodity occurrences in the area, using a microcomputer retrievable format. The project is supported by the MNDM Northern Development Fund.

The data base enables efficient fact storage, search and retrieval on the basis of one or several parameters. Applied to the consolidation of mineral deposit data from older government reports, assessment files, recent Ontario Geological Survey (OGS) mapping, and Wawa Resident Geologist's office (WRGO) staff observations, these features provide:

1. rapid access to data on specific occurrences
2. a means of exploring geological relationships among deposits
3. identification of critical knowledge gaps, within individual deposits or the data base as a whole, which would direct further study

The evolution of the present data base from published mineral deposit data bases has been detailed in the *Report of Activities 1987, Resident Geologists* (Tortosa et al. 1988, p.178, 180).

The software used for the data base is now dBase IV®, replacing dBase III PLUS®. Relational Report Writer® software is used to print the data base contents.

A user-friendly screen menu developed by P. Beach now allows search and retrieval of data base files without operational knowledge of dBase IV® and Relational Report Writer® software. P. Beach also contributed to the project by digitizing the map location of the mineral occurrences.

The design of the new screen menu now simplifies file searching. In addition to direct file access by property name, locally assigned Wawa Mineral Deposits Database map number, or the Ontario Mineral Deposits Inventory number (when available), the files now can be searched using up to three of the following parameters: township or area, property status, commodity, mineralogy, host rock, deposit form, metamorphic grade and alteration minerals. Searches are conducted using whole words or abbreviations.

The data base contents are entered into a three-screen format using up to 64 fields. Nine of these are memo fields that accept text information of up to 5000 characters each. This feature enables the recording of extensive information, when available, in a single field. Future developments will include the use of dBase IV® to search within memo fields and the use of QUIKmap® software to link data base files with digitized base maps. The latter feature will allow the on-screen access of location maps directly from data base records and vice versa. It also will enable the user to obtain a map copy of the locations of occurrences of interest.

An abbreviated version of the data base files was developed using a single screen, "short form" format. Use of this format is speeding the compilation of basic data for all known mineral occurrences in the Wawa Resident Geologist's District. The short form contains 19 data fields and the long form an additional 45 data fields. The extent of completion of these forms varies with the quality of available information. The main activity this year has been completion of short forms for all occurrences and continued upgrading and field testing of long forms. New information acquired during property examinations by geological staff is added to the data base, thus augmenting and correcting the records.

RECONNAISSANCE MAPPING, KABINAKAGAMI LAKE GREENSTONE BELT, HAWKINS TOWNSHIP EXTENSION

by A.C. Wilson

Introduction

The mapping program in the Kabinakagami Lake greenstone belt, which was initiated in 1988, continued during the 1989 field season. Field work was concentrated on the extension of the greenstone belt which occurs in Hawkins Township, immediately east of the area examined in 1988 (Tortosa et al. 1989, p.193-198).

Hawkins Township has received sporadic exploration attention since gold was discovered in the eastern part of the township in 1923. Original mapping of the area occurred in 1916 when T.L. Tanton, of the Geological Survey of Canada, mapped along the railway and adjacent waterways (Maynard 1929, p.114). J.E. Maynard carried out the first, and only, detailed mapping of the township at a scale of 2 inches to 1 mile (1:31680) for the Ontario Department of Mines in 1929. No other geological mapping, with the exception of maps produced for assessment credit, has been reported.

The presence of three reported gold occurrences in the township, in addition to a past-producing gold mine in Lizar Township (Hiawatha Gold Mine), has resulted in renewed exploration interest in the greenstone belt.

Outcrop exposure in the area is extremely poor. Recent logging activity in the area has enhanced the exposure of outcrops, as has an unreported stripping program in the southwest corner of the township. Field work was restricted to those portions of the township where the likelihood of finding outcrop was best.

Additional geological information has been compiled from the assessment files and added to the preliminary map. This information has aided in filling in those gaps in the mapping which resulted from access difficulties.

Funding for the program is provided through the Northern Ontario Regional Economic Development

Fund (NOR-DEV). An open file report is scheduled to be released at a later date, and will summarize the results of the two-year mapping program.

Location and Access

Hawkins Township is located in the extreme northeastern corner of the Wawa Resident Geologist's District, approximately 116 km north-northeast of Wawa (*see* Figure 10.6). The township lies immediately east of the Kabinakagami Lake area mapped by Siragusa (1973a, 1973b) and examined by Wilson (1988) (*see* Tortosa et al. 1989, p.193-198).

Access to the township is either by a complex series of logging roads from Hornepayne, or by 110 km of all-weather roads from Hearst. Within the township, access is by four-wheel drive vehicle and by all-terrain vehicle. The northwestern and southeastern sections of the township are not easily accessible.

Geology

Current mapping in Hawkins Township has yielded few fundamental changes in the basic geometry of the greenstone belt as presented by J.E. Maynard in 1929. More detailed litholgical and structural observations are presented here.

Mafic to Intermediate Metavolcanic Rocks

Mafic metavolcanic rocks form the dominant rock type visible in the area (Figure 10.7). In many cases, amphibolite grade metamorphism has obscured primary volcanic structures. The major mafic metavolcanic units identified in the township are: 1) amphibolitic flows; 2) pillowed flows; 3) strongly foliated fine-grained flows with epidote and quartz-rich lenses; and 4) finely laminated mafic tuffs. All mafic metavolcanic units are uniformly dark green to black in colour on their weathered surfaces.

Amphibolitic flows may be fine or medium grained, and display a strong foliation. In some locations, localized shearing has produced a unit which is chlorite rich, fine grained and extremely friable. This unit has been locally termed a chlorite schist.

Pillowed flows, where identified, have a short strike extent and are intercalated with amphibolitic flows and

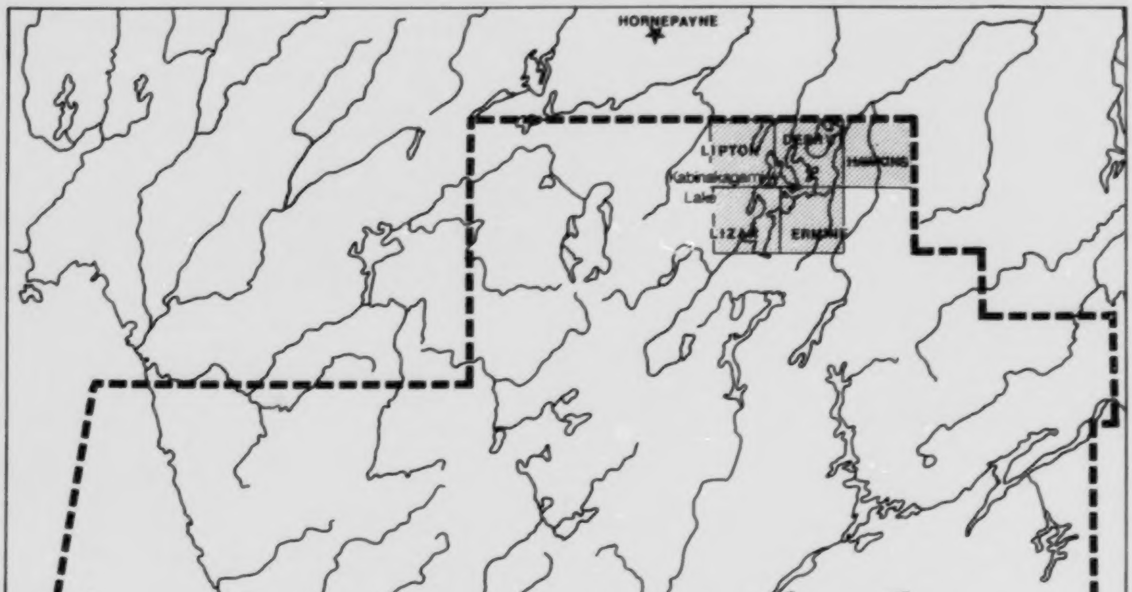
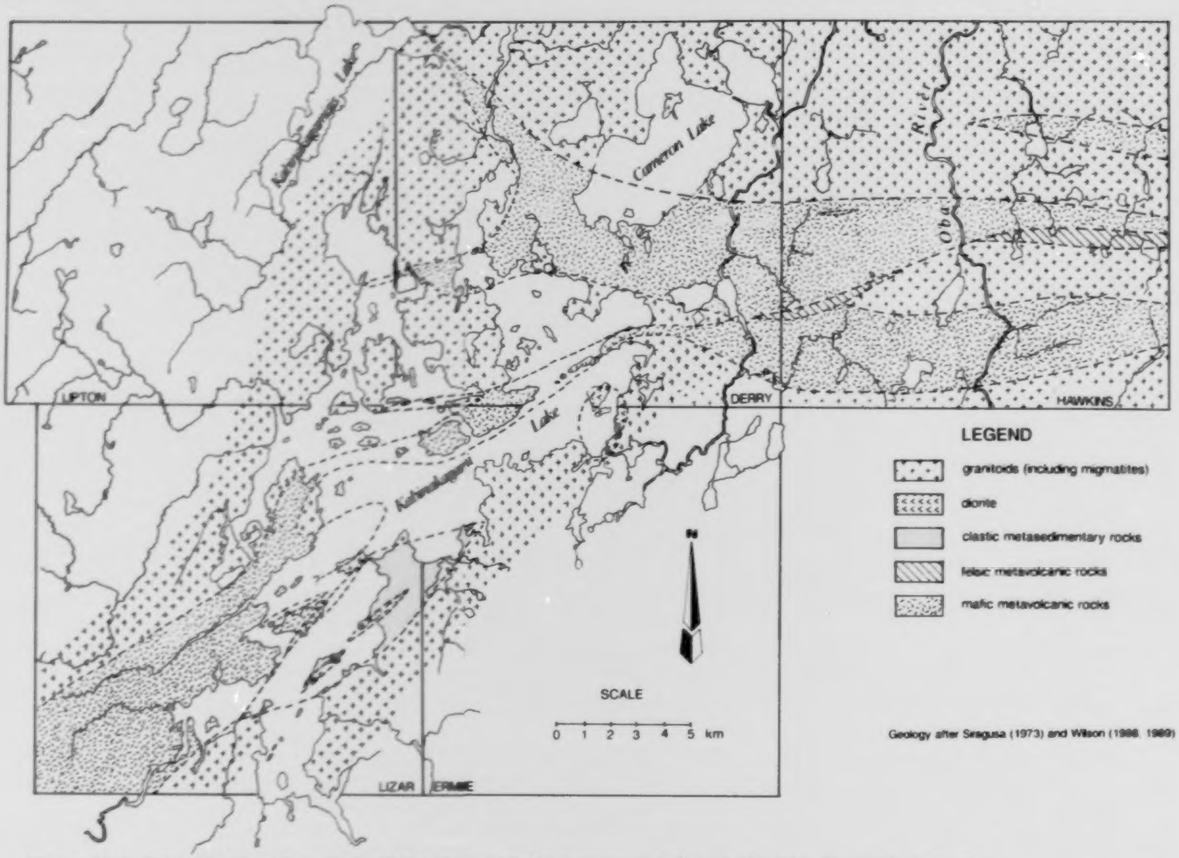


Figure 10.6. Location map for the Hawkins Township mapping project.



Geology after Siragusa (1973) and Wilson (1988, 1989)

Figure 10.7. Generalized geology of the Kabinakagami Lake greenstone belt and Hawkins Township extension.

mafic tuffaceous rocks. The pillows are irregular in shape and range from 10 to 25 cm in size. Pillow centres are altered to epidote and the selvages are typically strongly carbonate altered. No top indicators were found in the pillowed units.

Narrow units of strongly foliated mafic metavolcanic rocks with 5 to 10 percent quartz and epidote lenses also occur intercalated within the mafic metavolcanic unit. A similar unit also outcrops on Kabinakagami Lake (Tortosa et al. 1989, p.193-198).

Mafic tuffs form the dominant mafic rock type, and are especially prominent in the southern section of the township. The tuffs are finely laminated and contain up to 10 percent narrow felsic interbeds. The interbeds are usually fine grained and strongly foliated, and may be locally boudinaged. Felsic layers range in width from 1 to 10 cm, and are interpreted to be felsic tuffs.

All units have been subjected to regional upper greenschist to lower amphibolite grade metamorphism.

Intermediate to Felsic Metavolcanic Rocks

Two intermediate to felsic metavolcanic rock units outcrop in the township. In the central portion of the township, a strongly foliated, east-trending, light grey-weathering unit outcrops in the vicinity of the three known mineral occurrences (*see* Figure 10.7). This rock is characterized by a fine-grained texture, a siliceous appearance, and contains small (1 to 2 cm) lenses of quartz which frequently are nucleated around a pyrite-rich core. Sulphides are disseminated liberally throughout the unit. This unit appears to be tuffaceous in origin.

The second intermediate to felsic rock unit is much narrower and appears in the southwest corner of the township. This unit consists of strongly foliated intermediate to felsic tuffs intercalated with a felsic fragmental unit (width unknown due to scarcity of outcrop). The fragmental unit is strongly foliated and contains 25 to 35 percent elongated clasts which are dominantly intermediate in composition. Undeformed intrusive clasts also are present, but they form less than 3 percent of the fragments.

Quartz-feldspar porphyry sills and dikes are prevalent in the southwest portion of the township. These rocks are white to light grey on the weathered surface and contain large quartz and feldspar phenocrysts (0.5 to 1 cm in size) which constitute up to 25 percent of the rock. These intrusions have been interpreted to be synvolcanic.

Clastic Metasedimentary Rocks

Narrow bands of metagreywacke have been mapped within the mafic metavolcanic unit. The intercalated layers are generally not laterally continuous and occur as isolated outcrops. This metagreywacke is light tan on the weathered surface and is garnetiferous. No primary bedding is preserved in these units.

Felsic Intrusive Rocks

The metavolcanic sequence exposed in Hawkins Township is enclosed to the north and south by strongly foliated, to locally gneissic, granodioritic to tonalitic intrusions. These rocks are typically medium to coarse grained, and biotite forms the dominant mafic component. Locally, the granitoids are injected with aplite and pegmatite veins and dikes.

Late Mafic Intrusive Rocks

All units are crosscut by a dominant series of southeast-trending diabase dikes. In most cases, the diabase is coarse grained and contains up to 5 percent euhedral magnetite crystals. A second, less prominent set of southwest-trending dikes also crosscuts the stratigraphy.

Structural Geology

Two styles of deformation have been observed in the metavolcanic sequence outcropping in the township. In the central part of the township, the rocks are strongly foliated and sheared along an easterly trend. The foliations dip steeply, and in many locations, dips are vertical. Short localized shear zones, usually represented by chloritic schists, trending between 130° and 155°, have been observed to crosscut the main structural trend of the greenstone belt.

A more ductile style of deformation occurs in the southwest corner of the township. The rocks are much less intensely foliated and the foliation direction is more variable. The overall trend of the foliation is southeast and dips moderately to the south. Local, small-scale, complex folding is displayed in both the mafic tuffs and the quartz-feldspar porphyry sills and dikes. Chloritic shear zones are noteably absent in this area.

Economic Geology

Three known gold occurrences are located in Hawkins Township. All three occur within the strongly sheared metavolcanic rocks in the central part of the township and, more importantly, they appear to be spatially related to the sheared contact between the mafic and felsic metavolcanic units. More detailed observations on the Langdon showing, the Shenango Gold Mine and the Taylor showing are located elsewhere in the text.

One other gold occurrence, in Walls Township, east of the Taylor showing, appears to be related to the same sheared mafic-felsic metavolcanic contact.

It is important to note that all of the known mineralization in Hawkins Townhip exists in those areas where: 1) there is a strongly sheared contact between mafic and felsic metavolcanic rocks; 2) pyrite content of the surrounding rocks is greater than 5 percent; and 3) the carbonate alteration is strong and the corresponding epidote content of the rocks is minimal. Assessment file research and field observations indicate that those areas of the township that are host to abundant quartz-feldspar porphyry dikes and sills, are not coincident with anomalous gold values.

A molybdenum occurrence, the Seagers claim (Maynard 1929, p.122), is located approximately 3.2 km south of Langdon Station, on the east bank of the Oba River (*see* Figure 10.5). Old workings of shallow pits, trenches and stripped outcrops are reported in the assessment files (Wawa Resident Geologist's office). One to 3 percent pyrite and less than 1 percent molybdenum flakes occur disseminated in quartz veins, granitic dikes and felsic tuffaceous interlayers within a mafic tuff. Anomalous molybdenum values of up to 114 ppm have been recorded in quartz veins in the felsic tuff. This property was not visited during the 1989 field program due to time constraints.

GEOLOGICAL DATA INVENTORY FOLIO PROGRAM AND EXPLORATION DATA MANAGEMENT

by W. Wing

Compilation of Geological Data Inventory Folios (GDIFs) continued in 1989 supported by the Northern Development Fund (Wawa Economic Development Initiatives). Priority was given to areas with high exploration activity and/or gold potential (*see* Figures 10.8 and 10.9).

A total of 67 Geological Data Inventory Folios are available for either viewing or purchase at the Wawa Resident Geologist's office. Of these, 20 are available in published form, with the remaining unpublished GDIFs being offered for the cost of photocopying. Efforts in 1989 were concentrated in the area of the Mishibishu Lake greenstone belt.

A total of 108 assessment files were added to the folios compiled by staff of the Sault Ste. Marie Resident Geologist's office in 1986. In addition, data from a number of government surveys were compiled and added to the folios for the Pukaskwa River, Abbie Lake, David Lake, Mishibishu Lake, Pilot Harbour NW, Pilot Harbour NE and Point Isacor areas and St. Germain and Groseilliers townships. Data for 31 percent of all townships, and 65 percent of those with high gold potential have been compiled (*see* Figure 10.8).

In 1989, 252 files were added to the Wawa Resident Geologist's office library of exploration data. Townships with new assessment data and available GDIFs are indi-

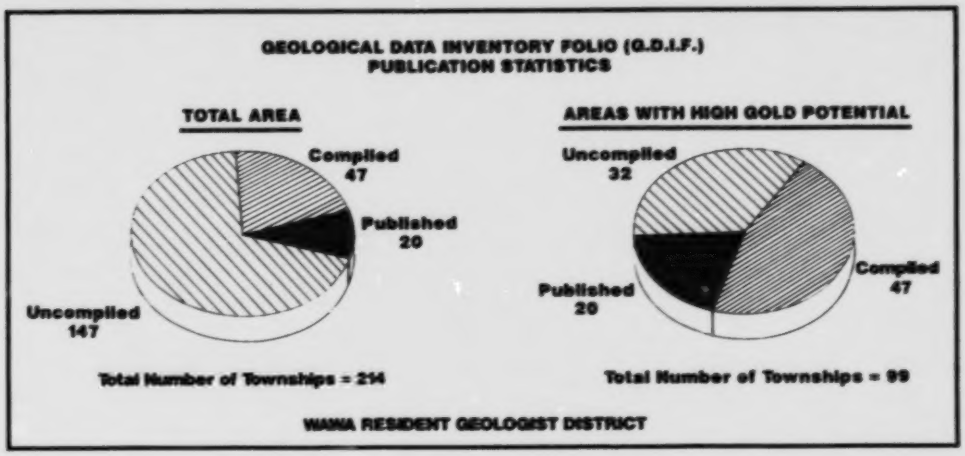


Figure 10.8. Geological Data Inventory Folios, compilation statistics.

cated on Figure 10.9. A list of assessment files is available on request.

Information gathered as a result of the Algoma Central Railway assessment file consolidation will be microfiched in 1990, and should be available to the public by late 1990.

COMPUTER APPLICATIONS AND MINERAL DEVELOPMENT RELATED PROJECTS

by P. Beach

Computer Applications

Using computer-assisted drafting (CAD®) software, a digitizing tablet and 1:50000 topographic maps as a base, townships in the Goudreau area, Kabinakagami Lake area and the Mishibishu greenstone belt area were converted to digital form to be used as base maps for a number of applications. A regional map covering the entire Wawa Resident Geologist's District was also digitized from a 1:250000 scale topographic base. These digitized maps have several advantages over traditional maps; they contain several levels of information which may be turned on or off; they can be plotted at any scale in any combination of colours; deletions or additions are possible in a matter of minutes; and plots of enlarged sections are possible. An attempt to develop a set of standards and efficient implemenatation techniques for geological based CAD® applications was initiated late in the year.

Commercial plotting software (QUIKmap®) was used to provide a linkage between dBase III PLUS® or dBase IV® data base files and digitized base maps. Digitized maps were transferred into QUIKmap® using standard Data Exchange Format (DXF) files. QUIKmap® software will plot point or polygon data from an existing data base onto the monitor or as hard copy. It is possible to create records in a selected data base from point or polygon data on a digital base map. Linkage between several data bases at once is also possible. Simply selecting a point symbol or polygon on screen from the base map will allow retrieval of the contents of the data base for that location. However, QUIKmap® is not analogous to Geographic Informations Systems software, in that it does not have analytical capabilities and, as such, its cost is much lower.

A program with searching and printing capability, written in the dBase IV® programming language, was developed to provide a user-friendly menu system for gaining access to the Wawa Mineral Deposit Database file (*see* Wawa District Mineral Deposit Database section).

A pilot project was initiated with the Ontario Centre for Remote Sensing to determine whether it is possible to produce useful digitized base maps of water-boundary data from LANDSAT imagery. Initial results indicated that the resolution at a 1:50000 scale did not meet our requirements. The processed LANDSAT data is based on a 25 m pixel resolution. This technique will be tested at the 1:250000 scale.

Mineral Development

Several mineral development related projects were initiated and further developed with the implementation of a plotter, a large digitizing tablet, CAD® software and QUIKmap® software, which provides a graphics-data base linkage.

A first draft of the "Mines Impact Report" was completed during the early part of the year. This report, initiated in 1988, consists of a map and accompanying data base which shows the locations of commercial fishing lodges, environmentally sensitive areas, potential hydro sites, sand and gravel quarries and other potential resource conflict sites of which exploration companies in the Wawa area should be made aware.

Using digital base maps, an updated version of the data base and the QUIKmap® software, a computerized version of the "Mines Impact Report" was completed.

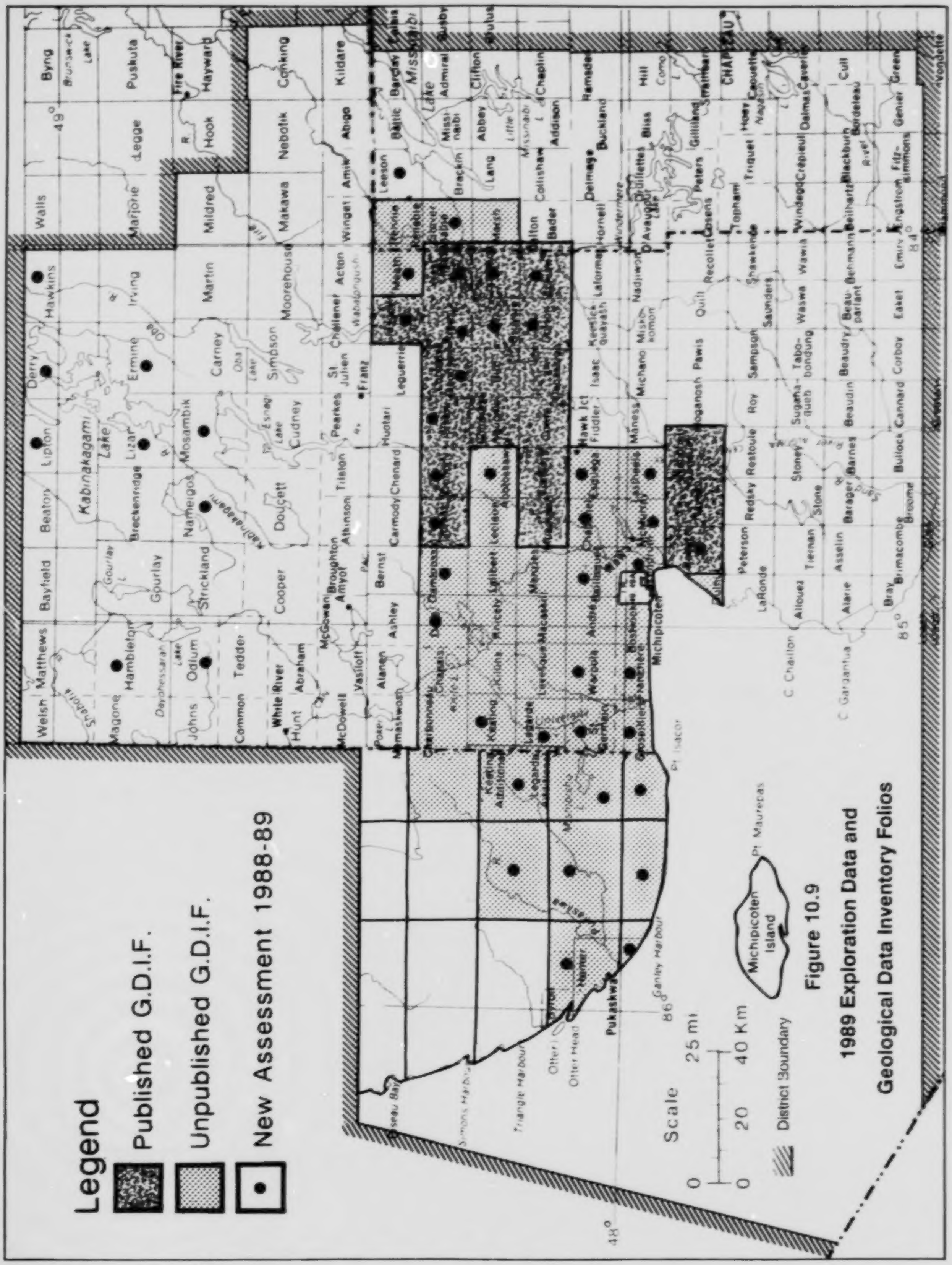

Legend
Published G.D.I.F.
Unpublished G.D.I.F.
New Assessment 1988-89
Scale
0 25 mi
0 20 40 Km
District Boundary
Michipicoten Island
Lake Superior shore
Wawa
Michipicoten
Kabinakagami Lake
Lake Missinaibi
CHAPLEAU
48°
49°
84°
85°
86°

Figure 10.9
1989 Exploration Data and Geological Data Inventory Folios

The mines impact data base was linked to the regional digital base map covering the Wawa Resident Geologist's District (1:250000 scale), as well as to the more detailed Mishibishu Lake area base map (1:50000 scale). Simultaneous linkage to the Wawa Mineral Deposits Database and an overlay of mineral potential information, such as greenstone belt locations, provided a better picture of potential resource conflict sites.

The biggest advantages of the computerization of the mines impact information are the ease and speed of updating and replotting the information, allowing the information to be current at all times.

A second project initiated during 1988 was also continued to the completion of the first draft of a report entitled, "Provincial Acts and Permits Applicable to the Mining Sequence". This report consisted of a flowchart and data base which relate provincial permits and applicable legislation to the various stages of exploration and mine development. The report is a simple reference manual which allows exploration companies to determine which permits may be required, and which government acts and legislation apply, and to whom further inquires should be directed. The acts and permits information was also linked to the digitized flowchart with the acts and permits data base using the QUIKmap® software.

DIAMOND-DRILL CORE STORAGE PROGRAM

by J.R. Walmsley

Permanent staff for the Sault Ste. Marie Drill Core Library presently consists of J.R. Walmsley as Drill Core Library Geologist and D. Messenger as Drill Core Library Assistant. D. Messenger completed a six-month training assignment at the end of February that involved the exchange of positions between himself and P. Morra, the Mining Claims Inspector. Temporary staff included Experience '89 summer assistant J. Nichols, who also served a three-month term as a co-op student prior to the summer. Other co-op students included S. Anderson and A. Borelli.

During the year, the drill core library reached its maximum storage capacity. In order to accommodate new donations, an outside core storage program was initiated. The purpose of outdoor storage is to eliminate the need for telescoping of core and thus preserving the integrity of the drill holes. Drill core designated for outdoor storage has been selected primarily on the basis of redundant information and assay data.

During 1989, drill core from 54 holes totalling 16954 m, was collected by library staff. Core from the Wawa Resident Geologist's District totalled 1229 m. This included donations from Cominco Ltd., Bruyere Township (762.5 m), and New Beginnings Resources Inc., West Township (257.9 m); both townships are in the Missanabie-Dog Lake area. The total inventory of the library is 84762 m with 76390 m stored inside and 8372 m stored outside.

Donations this year exceeded last year by over 7500 m. Future collections will emphasize the Mishibishu Lake area. For anyone wishing to donate core, please contact the appropriate Resident Geologist's office or the Drill Core Library.

The use of the Sault Ste. Marie Drill Core Library by government personnel, independant prospectors and company representatives was about equal with that of 1988. Anyone wishing to view core should notify the library in advance to insure that drill core stored outside can be brought to the facility. Inventory catalogues may be obtained by contacting the Resident Geologist's office (in Wawa or Sault Ste. Marie) or the Sault Ste. Marie Drill Core Library.

RECOMMENDATIONS FOR EXPLORATION

Hawkins Township Gold Prospects

A reconnaissance study of Hawkins Township during the 1989 field season indicates a strong similarity in the geology among the three mineral occurrences visited (Langdon showing, Shenango Gold Mine and Taylor showing). All three lie along a steeply dipping, east-trending contact between a mafic metavolcanic unit, to the north, and a felsic tuffaceous unit. The contact and surrounding rocks have both been strongly sheared. Anomalous gold assays have been recorded along the length of this zone.

A fourth gold occurrence, documented on the regional compilation map of the area, is located in Walls Township, approximately 6.0 km east of the Taylor showing (Carlson et al. 1974). Although this property was not visited, it is probable that the showing is hosted by the same sheared mafic-felsic metavolcanic contact, and that anomalous gold values would occur along the length of the contact in Walls Township.

Initial investigation of Hawkins Township indicated that the northern belt of greenstone which outcrops in the north central part of the township represents a 1.5 to 2 km wide zone of intense deformation and shearing (*see* Figure 10.7). This zone is referred to here as the Langdon Lake shear zone (LLSZ).

All evidence suggests that the LLSZ extends both eastward into Walls Township and westward into Derry Township (Tortosa et al. 1989, p.193-198). Outcrop exposure is poor (< 5%) and most of the area is occupied by spruce swamps. In order to assess the gold-bearing potential of the length of the shear zone, a program of stripping is recommended.

Two mines, the Shenango Gold Mine (Hawkins Township) and the Hiawatha Gold Mine (Lizar Township) have produced small amounts of gold in the area. Assay results suggest the possibility of additional small, low-grade, gold deposits along the LLSZ.

Base Metal and Precious Metal Potential, Wawa District

Base metal prospects that contain precious metals in anomalous or significant amounts occur throughout the district but have not received systematic attention as prospecting targets or as guides to other discoveries. Their general occurrence within the mafic-felsic transition of one (or more?) of the volcanic cycles of the Michipicoten greenstone belt and the fact that few have been identified to date (e.g., Conboy Lake (*see* Property Examinations section), Kozak Lake, Mammoth Metals, Falcon Creek) invites further exploration. Base metal occurrences with reported sphalerite should be re-examined for the presence of high temperature sulphides such as the high-iron ("blackjack") variety of sphalerite. Such higher temperature sulphide concentrations are good targets for associated precious metal mineralization.

The publication in the last few years of numerous preliminary bedrock maps by the OGS provides a good stratigraphic framework for base metal prospecting, and could be used effectively with the regional airborne magnetic and electromagnetic survey released in 1988 (Ontario Geological Survey 1987).

Granitic and Gneissic Terranes

Recent structural and mineral deposit studies in the Renabie–Missinabie area indicate a similar sequence of structural events has affected rocks within, and external to, the Michipicoten greenstone belt (Heather and Buck 1988; Heather 1989). High strain zones within the greenstone belt, which extend across the greenstone-granite contact, may result in the development of large structures such as the "Renabie break" due to the greater competency of the granitoid rocks.

Other areas where high strain zones intersect the granite-greenstone contact, especially at high angles, are promising prospecting targets on the granite side of the contact. Recent staking in the area north of White River may reflect the application of this concept to the Terrace Bay–Hemlo greenstone belt. Other target areas are the internal granitoids. The Ash Lake pluton, where large, gold-bearing quartz veins have been found (Ateba Mines Inc., Stover Township) is an example.

Within the granitoid terrane, greenstone enclaves such as the Dayohessarah Lake greenstone belt are relatively unprospected and have a geological setting similar to the Manitouwadge area which contains significant base metal deposits (i.e., Geco Mine).

A platinum group element occurrence was discovered in the northern part of the Sault Ste. Marie Mining Division. It is associated with mafic migmatites within tonalitic gneisses in close proximity to a hornblende diorite intrusive (Bennett et al. 1987). These examples provide additional incentive for more detailed prospecting of granitoid and gneissic terranes in the Wawa District.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The Wawa Resident Geologist's staff provided logistical support and temporary geological assistance to Ontario Geological Survey field crews during the summer. The Ontario Geological Survey had four field projects in the Wawa area during 1989 (Figure 10.1):

1. A geological and structural study of gold deposits in the Renabie area, by K.B. Heather.
2. The development of an integrated geoscience data base for the Goudreau area, by R.S. Mussakowski (Ontario Centre for Remote Sensing) and N.F. Trowell (Ontario Geological Survey) (*see* Research by Other Agencies section)
3. Lake sediment and water geochemical surveys in the Dog Lake area conducted by J.A.C. Fortescue.
4. Aggregate resources study along the road corridor from the Magnacon Mine to the Eagle River gold deposit, by G. Jones.
5. Synoptic study for the Wawa area by R. Sage.

PRECAMBRIAN GEOLOGY SECTION

R. Sage, in co-operation with the Wawa Resident Geologist's office, conducted the 8th annual spring field trip in the Wawa area. R. Sage and K. Heather, in co-operation with the Wawa Resident Geologist's office, led midsummer field trips in the Goudreau and Mishibishu Lake areas, respectively. These field trips have become a regular event giving companies in the area the opportunity to discuss and compare geology, structure and gold mineralization. This year the field trips attracted a combined total of over 100 participants.

R. Sage continued a two-year synoptic study of the Wawa area designed to summarize and synthesize the results of seven years of field mapping and analytical work, including geochronology, whole rock and trace element geochemistry.

K. Heather continued a multiyear gold metallogenic and structural study in the Michipicoten and Mishibishu Lake greenstone belts. The 1989 field work by K. Heather concentrated on the Renabie area (Heather 1989). A field trip, held for industry and government geologists at the end of the field season, reviewed some of the preliminary results of the study. The study indicated that the external tonalitic gneisses have been affected by similar deformation and mineralizing processes as those which have affected the adjacent greenstone belt.

GEOPHYSICS/GEOCHEMISTRY SECTION

J.A.C. Fortescue completed a lake sediment and water survey of the Dog Lake area bringing total coverage to about 35 percent for the Michipicoten greenstone belt. Sampling consisted of obtaining long lake sediment cores at a sample density of 1 sample per km^2.

AGGREGATE ASSESSMENT OFFICE

G. Jones completed an aggregate inventory along the road corridor from the Eagle River deposit (Noranda Exploration Company, Limited) north, past the Magnacon Mine (Muscocho Explorations Limited). Results of the study indicate that there are sufficient sand and gravel resources to meet the anticipated demands in the Eagle River–Magnacon road corridor.

RESEARCH BY OTHER AGENCIES

ONTARIO CENTRE FOR REMOTE SENSING (OCRS)

The Ontario Centre for Remote Sensing (OCRS) is working with the Ontario Geological Survey in order to develop an integrated geoscience data base which will provide new methods for interpreting and displaying available geological data (Mussakowski 1989). The Ontario Centre for Remote Sensing is also working with the Wawa Resident Geologist's office on a pilot project to convert waterbody Landsat imagery into digital (vector) base maps for use with CAD® software.

The OCRS produced a series of radar/magnetic images of the Wawa District at 1:50000 and 1:100000 scales which have been placed on display at the Wawa Resident Geologist's office. These maps provide useful information on geology, structure and geophysics and have been useful to exploration companies.

GEOLOGICAL SURVEY OF CANADA

R.I. Thorpe continued lead isotope geochronological studies of galena from gold deposits in the district.

BOWLING GREEN STATE UNIVERSITY

M.H. Cohen, MSc candidate, completed a study of the petrography and paragenesis of the siderite orebody, G.W. MacLeod Mine, Wawa.

T.A. Harding, MSc candidate, completed a study of the precious metal geochemistry of the Helen Siderite, G.W. MacLeod Mine, Wawa.

QUEEN'S UNIVERSITY

Z.G. Arias, MSc candidate, continued field work northeast of Wawa in her study of the tectonic evolution of the central and eastern part of the Michipicoten greenstone belt.

UNIVERSITY OF MASSACHUSETTS

G.E. McGill, Professor, Department of Geology, continued structural studies in central and northeastern Chabanel Township for a sixth season. He is developing a tectonic history of the south-central part of the Michipicoten greenstone belt.

M. Nadakavukaren, MSc candidate, completed field work for a study of alteration within the mafic volcanic rocks that overlie the Lucy Iron Range, Chabanel Township.

UNIVERSITY OF OTTAWA

H.J. Hofmann, Professor, Department of Geology, is studying the possible biological origin of concretionary structures that occur within pyritic siderite in the George W. MacLeod Mine, Wawa.

ACKNOWLEDGMENTS

Information for the section on Resident Geologist's Staff Activities was provided by staff. The sections on Property Examinations were written by E.D. Frey (Conboy Lake Zinc-Silver Prospect) and by A.C. Wilson (Langdon Showing, Taylor Showing and Shenango Gold Mine). The section Recommendations for Exploration was written by A. Wilson (Hawkins Township area) and E. Frey (base metal potential) and D. Tortosa (Granitic and Gneissic Terrane). The section on Ontario Geological Survey Activities was written by D. Tortosa; information for the section Research by Other Agencies was compiled by E. Frey and D. Tortosa. The section on Selected Publications Received was compiled by E. Frey, B. Leschishin and D. Tortosa. E. Frey reviewed and edited the manuscript together with A.C. Wilson, and compiled additional information for the sections on mining, development and exploration activity.

SELECTED PUBLICATIONS RECEIVED

Betournay, M.C. ed. 1989. Surface crown pillar evaluation for active and abandoned metal mines; International Conference Proceedings, Timmins, Ontario, 216p.

Callan, N.J. 1988. Syn-deformational shear zone-hosted Au-quartz vein mineralization in TTG host rocks, Renabie Mine area, north Ontario: structural analysis, microstructural characteristics and vein paragenesis; unpublished MSc thesis, University of Toronto, Toronto, 175p.

Cohen, M.H. 1989. Petrography and paragenesis of the siderite orebody, MacLeod Mine, Wawa, Ontario; unpublished MSc thesis, Bowling Green State University, Ohio, 63p.

Colvine, A.C., Cherry, M.E., Dressler, B.O., White, O.L., Barlow, R.B. and Riddle, C. eds. 1989. Summary of field work and other activities; Ontario Geological Survey, Miscellaneous Paper 146, 275p.

Friske, P.W.B. 1985. Regional geochemical reconnaissance. Interpretation of data from the north shore of Lake Superior; Geological Survey of Canada, Paper 84-21, 38p.

Garland, G.D. 1989. Proceedings of exploration '87. Third decennial international conference on geophysical and geochemical exploration for minerals and groundwater; Ontario Geological Survey, Special Volume 3, 914p.

Goode, A.D.T. and Bosma, L.I. compilers 1988. Bicentennial gold 88, extended abstracts oral programme; Geological Society of Australia Abstracts Series, no.22, Melbourne, 369p.

Goode, A.D.T., Smyth, E.L., Birch, W.D. and Bosma, L.I. compilers 1988. Bicentennial gold 88, extended abstracts poster programme; Geological Society of Australia Abstracts Series, no.23, Melbourne, 662p.

Halls, H.C. 1989. Regional Hudsonian(?) deformation of the Superior Province: paleomagnetic evidence from 2.45 GA Matachewan dykes, Ontario; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A104.

Harding, T.A. 1989. Precious metal geochemistry of the Helen Siderite, MacLeod Mine, Wawa, Ontario; unpublished MSc thesis, Bowling Green State University, Ohio, 51p.

Harris, D.C. 1989. The mineralogy and geochemistry of the Hemlo gold deposit, Ontario; Geological Survey of Canada, Economic Geology Report 38, 88p.

Heather, K.B. 1989. Variations in the regional structural control on gold mineralization: examples from the Wawa gold camp, Ontario; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A119.

Hodder, R.W. and Petruk, W. 1982. Geology of Canadian gold deposits; *in* Proceedings of the CIM Gold Symposium, 1980, Canadian Institute of Mining and Metallurgy, Special Volume 24, 286p.

Jemielita, R.A. and Spooner, E.T.C. 1989. An evolutionary trend of Na enrichment in Archean trondhjemite-tonalite-granodiorite (TTG) intrusions which host Au-quartz vein mineralization in the Renabie area, Wawa, Ontario; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A118.

Moser, D.E. 1989. Geology of the Wawa gneiss terrane adjacent to the Kapuskasing structural zone near Chapleau, Ontario; Geological Survey of Canada, Open File Map 2056, scale 1:50 000.

Mussakowski, R., Trowell, N.F., Sage, R.P. and Heather, K.B. In Press. Digital integration of remote sensing and geoscience data for the Goudreau–Lochalsh study area, Michipicoten greenstone belt, Wawa, Ontario; *in* Proceedings of the Seventh Thematic Conference on Remote Sensing for Exploration Geology, Calgary.

Reilly, B.A. 1989. Structural evolution of the western Michipicoten greenstone belt; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A37.

Smith, E.S., Farquar, R.M. and Tatsumoto M. 1989. Assessment of the U-Th-Pb system in two Archean metabasalts: deciphering the complex histories of sulphides and silicates using acid leach methods; Geochimica et Cosmochimica Acta, v.53, p.2051-2068.

Spooner, E.T.C. and Jemielita, R.A. 1989. Syn-shear Au-quartz vein/shear zone mineralization in the Wawa domal gneiss terrane, Renabie area, Wawa, Ontario: TTG magma "degassing" structures; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A102.

Taylor, R.P. and Strong, D.F. eds. 1988. Recent advances in the geology of granite-related mineral deposits; Canadian Institute of Mining and Metallurgy, Special Volume 39, 445p.

Turek, A. and Keller, R. 1989. U-Pb ages for the Mishibishu greenstone belt near Wawa, Ontario; *in* Geological Association of Canada–Mineralogical Association of Canada Annual Meeting, Program with Abstracts, v.14, p.A55-A56.

REFERENCES

Bennett, G., Leahy, E.J., Donald, J.P., Frey, E., Kral, J.J. and Tortosa, D.J.J. 1987. Sault Ste. Marie Resident Geologist's area, Northeastern Region; *in* Report of Activities 1986 Regional and Resident Activities, Ontario Geological Survey, Miscellaneous Paper 134, p.233-255.

Carlson, H.D., Donovan, J.F., Thurston, P.C., Sage, R.P. and Siragusa, G.M. 1974. Chapleau–Foleyet; Ontario Geological Survey, Geological Compilation Series Map 2221, scale 1:253 440.

Ferguson, S.A., Groen, H.A. and Haynes, R. 1971. Gold deposits of Ontario, part 1; Ontario Department of Mines, Mineral Resources Circular 13, p.72.

Giblin, P.E. 1968. Notes on mineral occurrences, Hornepayne sheet, Map P.476, Geological Compilation Series; Ontario Department of Mines, Miscellaneous Paper 20, 19p.

Heather, K.B. 1986. Mineralization of the Mishibishu Lake greenstone belt, District of Thunder Bay; *in* Summary of Field Work and Other Activities 1986, Ontario Geological Survey, Miscellaneous Paper 132, p.283-291.

——1989. The geological and structural setting of gold mineralization in the Renabie portion of the Missanabie–Renabie gold district, Wawa gold camp, Wawa; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.99-107.

Heather, K.B. and Arias, Z.G. 1987. Geological setting of gold mineralization in the Goudreau–Lochalsh area, District of Algoma; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.155-162.

Heather, K.B. and Buck S. 1988. The geological and structural setting of gold mineralization in the Missanabie–Renabie district of the Michipicoten greenstone belt, Wawa Ontario; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.257-270.

Maynard, J.E. 1929. Oba area, District of Algoma; Ontario Department of Mines, Annual Report, 1928, v.38, pt.6, p.114-125.

Mussakowski, R. and Trowell, N.F. 1988. Digital integration of remote-sensing geoscience data into a geoscience database for the Goudreau–Lochalsh study area, Michipicoten greenstone belt; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.271-280.

——1989. Applications of remote sensing to geology; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.189-193.

Ontario Geological Survey 1987. Airborne electromagnetic and total intensity magnetic survey, Wawa area, districts of Algoma, Sudbury and Thunder Bay; Ontario Geological Survey, Maps 81 003 to 81 034, scale 1 to 20 000.

Siragusa, G.M. 1973a. Kabinakagami Lake area, Derry and Erimine townships, District of Algoma; Ontario Division of Mines, Preliminary Map P.813, scale 1:31 680.

——1973b. Kabinakagami Lake area, Lipton and Lizar townships, District of Algoma; Ontario Division of Mines, Preliminary Map P.812, scale 1:31 680.

——1977. Geology of the Kabinakagami Lake area, District of Algoma; Ontario Division of Mines, Report 159, 39p.

Tortosa, D.J.J., Frey, E.D., Wilson, A.C., Wing, W., Ashick, L. and Melisek, J. 1988. Wawa Resident Geologist's area—1987; *in* Report of Activities 1987, Resident Geologists; Ontario Geological Survey, Miscellaneous Paper 138, p.175-197.

Tortosa, D.J.J., Frey, E.D., Stewart, R.C., Wilson, A.C., Wing, W., Ashick, L. and Melisek, J.D. 1989. Wawa Resident Geologist's District—1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.181-206.

11. Sault Ste. Marie Resident Geologist's District—1989

G. Bennett[1], E.J. Leahy[2] and J. Walmsley[3]

[1]Resident Geologist, Sault Ste. Marie Resident Geologist's Office, Northeastern Region.

[2]Staff Geologist, Sault Ste. Marie Resident Geologist's Office, Northeastern Region.

[3]Drill Core Library Geologist, Sault Ste. Marie Drill Core Library, Northeastern Region.

INTRODUCTION

Uranium mining at Elliot Lake represented the only mineral production from the Sault Ste. Marie Resident Geologist's District in 1989. Mineral exploration activities were mostly directed towards gold, but base metals also attracted some attention. Use of the Resident Geologist's office facilities dropped noticeably during the year, but it appeared that local prospectors were spending more time in the field. The introduction of the Ontario Prospectors Assistance Program (OPAP), late in the year (October), sparked much interest and is already acting as a catalyst for 1990.

MINING ACTIVITY

Denison Mines Limited continued production of uranium oxide from its mine and mill at Elliot Lake, where bacterial leach recovery is being successfully carried out in addition to conventional mining and recovery methods.

In early 1987, Denison Mines Limited purchased the mining leases of Canuc Resources Inc. on the south boundary of Denison's Elliot Lake property. In 1989, production began from the area of the Canuc leases. The grade obtained so far has exceeded projections based on surface drilling (A. MacEachern, Denison Mines Limited, personal communication, 1989). Canuc Resources Inc. will receive a royalty of $1.025 per pound of uranium oxide contained in broken ore (The Northern Miner, July 4, 1988).

Mechanical problems with the gears and shaft of Denison's autogenous grinding mill hampered production during the first half of 1989. These problems have been overcome and mill throughput improved in the third quarter of 1989 (Denison Mines Limited, Third Quarter report, 1989).

Denison Mines Limited has approximately 1590 active employees in the Elliot Lake area.

The recovery of yttrium as a by-product of uranium processing provides 150 tonnes of yttrium oxide per year; enough to supply one third of the world's needs.

Rio Algom Limited continued operation of the Quirke, Stanleigh and Panel mines in the Elliot Lake area. Bacterial leach recovery of low-grade ore supplements conventional mining methods.

Rio Algom Limited has approximately 2370 employees engaged in uranium mining in the Elliot Lake camp.

EXPLORATION ACTIVITY

Between November 17, 1988 (the final date of reckoning for last year's annual report), and November 17, 1989, there were 368 new mining claims recorded in the area administered by the Sault Ste. Marie Resident Geologist's office. This figure is down considerably from 1988, but this is not surprising because much of the area of recent interest—the western part of the Batchawana greenstone belt—was already staked in 1987 and 1988 (*see* Figure 11.1 and Table 11.1).

Belmoral Mines Ltd.-Aurora Gold Ltd.

In 1988, Aurora Gold Ltd. carried out geophysical work in Plummer and Aberdeen townships around the area of the old Rock Lake copper mine. This mine produced over 1.5 million pounds of copper between 1899 and 1903. In 1989, Belmoral Mines Ltd. reached an agreement with Aurora Gold Ltd. on the property, and in October of this year, drilled four holes with a combined total length of 2003 feet. (The Northern Miner, Oct. 30, 1989, p.6; V. Popov, Belmoral Mines Ltd., personal communication, October 1989.)

Blue Heaven Resources Corp.

In April of this year, the site of the old Gould copper mines in Gould Township was re-examined under option by the Blue Heaven Resources Corp. A strong, approximately east-west, shear zone hosts the major quartz vein carrying chalcocite, bornite, chalcopyrite, carbonates and specular hematite. Gould Copper Mine Ltd. had previously developed this vein with an adit, a drift and several raises. A mill and flotation cells are still on the property. Some concentrates were produced in the 1970s. This year, additional veins were exposed during stripping and washing of the outcrop. At the present time, line cutting is in progress to enable magnetic and a very low frequency electromagnetic (VLF-EM) surveys to be done. This will be followed by some induced polarization (IP) work, trenching, and probably drilling (G. Babcock, Blue Heaven Resources Corp., personal communication, November 1989).

Duration Mines Ltd.-Aurogin Resources Ltd.

Early in the year, an IP survey was carried out over a small part of the large claim block held by Duration

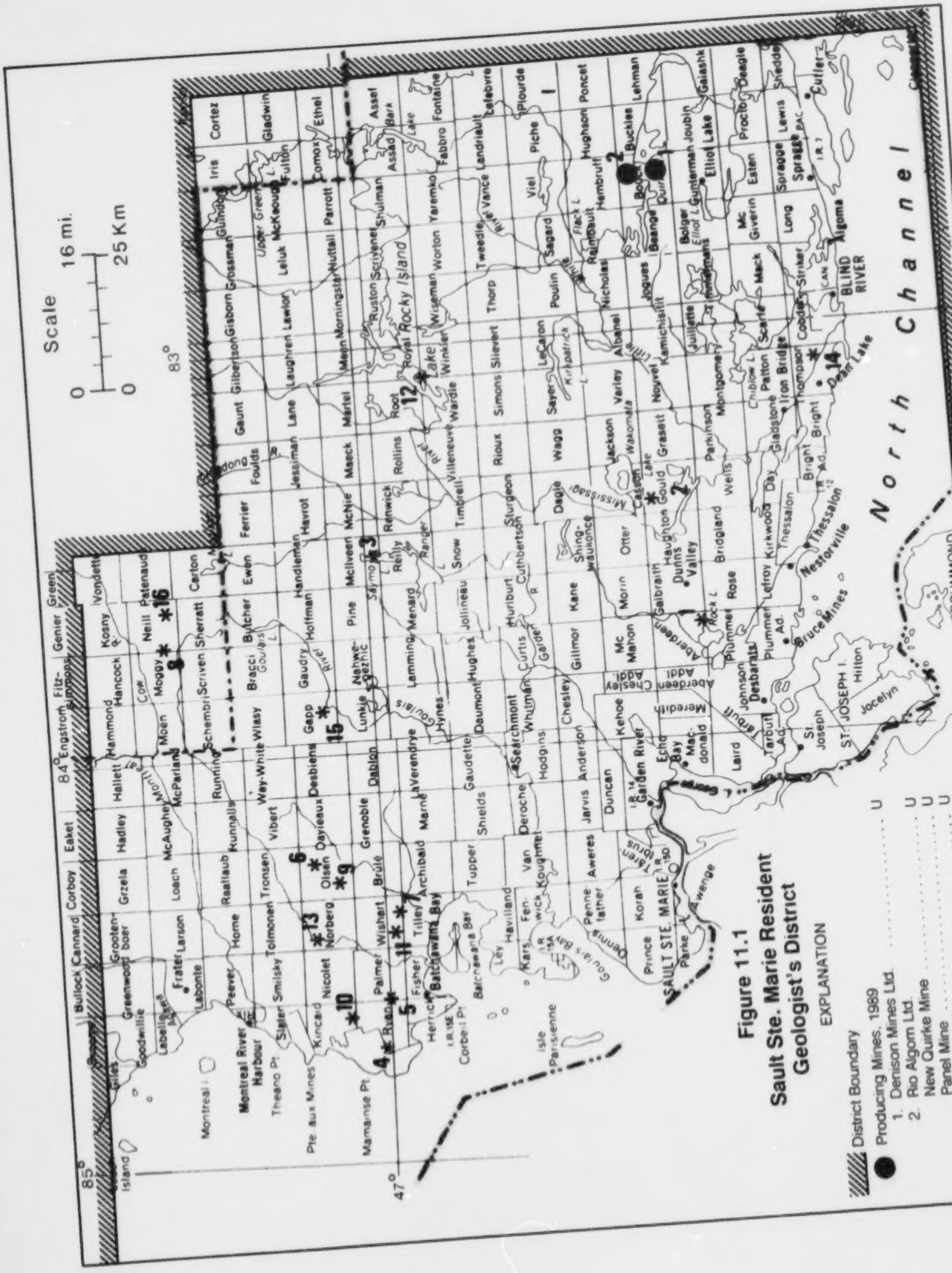

Scale
0 16 mi.
0 25 Km
85°
84°
83°
47°
46°
Lake Superior
North Channel
SAULT STE. MARIE
BLIND RIVER
Algoma
Thessalon
Bruce Mines
Echo Bay
Montreal River Harbour
Mamainse Pt.
Batchawana Bay
Goulais Bay
ST. JOSEPH I.
DRUMMOND ISLAND
Rocky Island Lake
Mississagi R.
Elliot Lake
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
District Boundary
Producing Mines, 1989
1. Denison Mines Ltd. U
2. Rio Algom Ltd.
New Quirke Mine U
Panel Mine U
Stanleigh Mine U
Exploration Activity, 1989 (keyed to Table 11.1)

Figure 11.1
Sault Ste. Marie Resident Geologist's District

EXPLANATION

TABLE 11.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1.	Belmoral Mines Ltd. - Aurora Gold Ltd.	Diamond Drilling
2.	Blue Heaven Resources Corp. - Gould Copper Mine Ltd.	Stripping, washing, linecutting
3.	Carroll	Sampling, assaying
4.	Doran - MacDougall - Palumbo	Prospecting, sampling, assaying
5.	Duration Mines Ltd. - Aurogin Resources Ltd.	Ground geophysical survey
6.	Fleming - Desjardins	Prospecting
7.	Fleming - Desjardins	Prospecting, sampling
8.	Frankow	Prospecting, sampling
9.	Gold Fields Canadian Mining Ltd.	Ground geological, geophysical and geochemical surveys; trenching, drilling
10.	Haugeneder - Richards	Prospecting, trenching, sampling, assaying
11.	Inco Gold Co.	Geological, magnetometer, E.M., geochemical surveys
12.	Lee Ron Enterprizes	Trenching, sampling
13.	Loydex Resources Corp.	Prospecting, sampling, assaying
14.	Lucuik - Koosel	Magnetometer survey
15.	Noranda Exploration Company Ltd.	Stripping, trenching, sampling and geochemical work
16.	Placer Dome Inc. - Glen Auden Resources	Geological, geophysical, geochemical surveys, diamond drilling

Mines Ltd.–Aurogin Resources Ltd. in Ryan and Palmer townships. There are at least eight mineralized showings on this property, each containing one or more of copper, cobalt, gold, molybdenum and silver. The companies still retain their optimism for the area (D. Rogers, Duration Mines Ltd., personal communication, November 1989).

Gold Fields Canadian Mining Ltd.

A large block of ground in Olsen Township was optioned to Gold Fields Canadian Mining Ltd. by a partnership of prospectors; Y. Desjardins, D. Fleming and Loydex Resources Inc. In December 1988, an airborne survey was conducted over this area, which was followed up in 1989 by geological, geophysical and soil geochemical surveys. Trenching, rock sampling and a small diamond drilling program were also done (D. Cameron, Gold Fields Canadian Mining Ltd., personal communication, November 1989).

Inco Gold Co.

Inco Gold Co. presently holds a block of 120 claims, stretching almost completely across Wishart Township at the southern edge of the Batchawana greenstone belt. Base and cross lines over about 60 percent of this area have been geologically mapped, followed by magnetometer and VLF-EM surveys. Soil geochemistry, B horizon, was done on a smaller portion of the grid area. A small claim group in Olsen Township was also subjected to reconnaissance geological mapping by the company. Further work is anticipated (J. Perry, Inco Gold Co., personal communication, November 1989)

Loydex Resources Inc.

Loydex Resources Inc. staked a block of claims in the northwest quarter of Norberg Township. Basic prospecting has revealed interesting zinc-lead mineralization with some silver (Y. Desjardins, L. Nelson, Loydex Resources Inc., personal communications, November 1989).

Noranda Exploration Company, Limited

In 1988, Noranda Exploration Company, Limited, optioned a 49-claim group in Gapp Township from Wolverine Resources Incorporated. The group of claims is underlain by mafic and felsic metavolcanic rocks and iron formation, and hosts showings of copper, lead, zinc and graphite. Quartz veins, tourmaline, carbonates, and green chrome (?) micas can also be found. Noranda has carried out soil geochemistry with analysis for gold, copper, lead, zinc and silver, along with stripping, trenching and sampling. Additional claims have been staked both to the east and west of the original option (P. Cooper, Noranda Exploration Company, Limited, personal communication, November 1989).

Placer Dome Inc.-Glen Auden Resources Limited

In 1989, Placer Dome Inc. conducted work on the Verse Lake property of Glen Auden Resources Limited in Neil Township. This included geological mapping, magnetic and VLF-EM surveys, rock geochemical analyses, and drilling (H. Newsome, Placer Dome Inc., personal communication, November 1989).

Other Exploration Activity

The following information was obtained by personal communication with parties involved.

G. Lucuik and J. Koosel conducted a magnetic survey over part of their claim group in Thompson Township. The group includes the old Bar-Fin Mine, a former copper producer.

W. Richards and J. Haugeneder did trenching and sampling on their "Creek Copper" occurrence in Kincaid Township.

D. Fleming and Y. Desjardins conducted basic prospecting and sampling on the former Just copper occurrence in Wishart Township and also on their claim groups in Olsen and Palmer townships.

D. Carroll staked and sampled a zinc occurrence in McIlveen Township.

Lee Ron Enterprizes continued work on their chalcopyrite showings in Root, Royal and Winkler townships.

P. Frankow has been prospecting and sampling his claims in Neill and Moggy townships.

F. Doran, D. MacDougall and L. Palumbo have prospected and sampled their various claim groups in Ryan, Kincaid and Palmer townships.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The staff of the Sault Ste. Marie Resident Geologist's office consists of G. Bennett, Resident Geologist, E.J. Leahy, Staff Geologist, and B. Fremlin, Secretary.

A great deal of the Resident Geologist's time was divided between administrative matters and responding to public, industry and ministry enquiries, which remained at a relatively high level in 1989. The Resident Geologist is a member of the Mineral Resources Inventory Working Group, an alternate on the Mineral Resources Inventory Management Committee and a member of the Ontario Geological Map Committee. The Resident Geologist attended the Uranium Resources Assessment Group (URAG) meetings held with key mining personnel of Denison Mines Limited and Rio Algom Limited in the spring of 1989.

Seven days were spent carrying out field investigations relating to the stratigraphy of the Elliot Lake Group, part of the Huronian Supergroup, in the Thessalon, Elliot Lake and Dunns Valley areas. A summary of the results of some of this work is included in this report. The Resident Geologist gave an oral presentation on the results of this work at the Ontario Mines and Minerals Symposium which took place in Toronto in December 1989. The Resident Geologist also completed a section dealing with lower Huronian stratigraphy for the forthcoming volume *The Geology of Ontario*.

During 1989, the Resident Geologist made seven visits to operating mines, four visits to inactive mineral occurrences, and conducted a field trip between Sault Ste. Marie and Elliot Lake for members of the Geology Department of the University of Michigan.

As in 1988, the Staff Geologist's time was spent mostly on four concerns: the Geological Data Inventory Folio (GDIF) System, mine hazard problems, educational matters including tourism, and office routine.

Following a meeting in December 1988, of GDIF compilers from all across the province, the final revisions to the GDIF format were all agreed upon. The Staff Geologist, assisted by L. Ashick, then completed the final draft and prepared the *Manual for the Preparation of the Geological Data Inventory Folio*. This was sent to Publication and Cartographic Services in Toronto who distributed copies of this manual, approved page formats and map strip labels to all Resident Geologist's offices in July. The plan is to enable each office, as time allows, to compile and produce GDIFs through their own region, but this procedure has not yet come into place.

As a member of the Bruce Mines Hazards Technical Committee, the Staff Geologist continued work in this area. Meetings were held with officials from the Municipality of Bruce Mines, Ministry of Natural Resources, Ministry of Labour, Ministry of the Environment, Ministry of Transportation and the Interministry Abandoned Mine Hazards Committee. Once the remedial work required was agreed upon, two summer students were employed to clear out around some of the hazard sites and two young offenders were utilized in painting fence posts and tying up sagging fencing around mine openings. A contract was let to do the required upgrading of existing protective fences and the installation of additional new fencing. This work began in December 1989. Meanwhile, the Ministry of Transportation is considering the alternatives for Plummer Street, the road that was closed last year.

The abandoned mine hazard work at Bruce Mines has had some interesting side effects, mostly of a positive nature.

1. The locations of the old mine workings have been pinned down to a degree of accuracy that was not available before, safety factors are being upgraded, and the closing of Plummer Street may have prevented a calamity just waiting to happen.
2. The area of land within the town that had been previously classified as Mine Hazard on the Official Plan and in the Zoning By-law, has been reduced considerably, to the benefit of the town.
3. The amount of historical data on the mining activities and social life in the Bruce Mines area from 1846 to 1876 that has come to light is significant and

copies of all these data are being turned over to the Bruce Mines Museum.

4. The significance and uniqueness of the Bruce Mines area, in the development of Canada's mining industry, is being realized by some of the townspeople. A committee has been formed with the Bruce Mines Chamber of Commerce, the North Shore Development Association, Bruce Mines Council members, and several interested citizens, with the aim of bringing this history to the attention of the tourist trade. The Staff Geologist is a member of this committee. The theme will centre around a day in the life of a miner of Bruce Mines, *circa* 1848.
5. The Sault Ste. Marie Resident Geologist's office was requested to submit a paper having to do with historical mining in Algoma for a magazine promoted by the Canadian Foresty Association. The Staff Geologist submitted an article entitled "Bruce Mines, Ontario—First Copper Mining Town in Canada". This magazine will be called *Sault Ste. Marie—Forestry Capital of Canada—1990* and is to be distributed right across the country.

In regard to educational concerns, the Staff Geologist made a presentation on elementary geology to grades 5, 6, 7 and 8 students at the C.O. Somes School in the village of Batchawana, about fifty miles north of Sault Ste. Marie. A labelled collection of large specimens of rocks, minerals and fossils, plus literature, was loaned to the school for their use for a three-week period.

Additional mining-related material was made available to the Sault Ste. Marie Museum. A whole floor of the museum is being designed to show the physical and social development of Sault Ste. Marie. Some diagrams provided by the Staff Geologist were used as a basis for the display on the geomorphological build up of the site of the city of Sault Ste. Marie.

Routine office matters employed much of the Staff Geologist's time, including discussions with prospectors, company geologists, consultants, rock hounds, teachers, the general public and government personnel. Advice was given on rock and mineral identification, assays, exploration, maps and reports, assessment files, etc. The introduction of the Ontario Prospectors Assistance Program (OPAP) in early October sparked much interest and raised many questions. The Staff Geologist made an evening presentation to the Sault Ste. Marie Prospector's Association about the program.

STRATIGRAPHY OF THE ELLIOT LAKE GROUP BETWEEN SAULT STE. MARIE AND THE QUIRKE LAKE SYNCLINE

by G. Bennett

Introduction

The Livingstone Creek Formation is the basal formation of the Huronian Supergroup, west of the Quirke Lake syncline. It may be as much as a few thousand metres stratigraphically below the Matinenda Formation, the basal unit of the Huronian throughout most of the Quirke Lake syncline and host to the important uranium deposits of the Elliot Lake camp. In spite of its stratigraphic significance, the Livingstone Creek Formation has received little attention from researchers.

This discussion is intended to provide the author's opinions regarding the stratigraphic relationships between the Livingstone Creek Formation, the Thessalon Formation and the Matinenda Formation. Many of the conclusions are based on unpublished data gained from field observations carried out between 1974 and 1989, and from the examination of drill core in the Sault Ste. Marie Drill Core Library.

The Livingstone Creek Formation

GENERAL DESCRIPTION

The Livingstone Creek Formation (Frarey 1967) is predominantly grey sandstone and polymicitic conglomerate which underlies volcanic rocks of the Thessalon Formation, and rests unconformably on early Precambrian basement rocks in the Thessalon, Sault Ste. Marie and Aberdeen Lake areas. No reference section has been proposed.

In the Sault Ste. Marie and Aberdeen Lake areas, the Livingstone Creek Formation is up to 1200 m (3600 feet) thick. In the Thessalon area, it ranges from 0 to 100 m (0 to 300 feet) thick (Frarey 1977, p.22).

The Livingstone Creek Formation consists almost entirely of fine- to medium-grained, grey arkose, subarkose and clast-supported polymictic conglomerate with rare wacke and siltstone. Trough cross-bedding and calcite-rich foresets are commonly present, and may be a characteristic feature of the formation.

Clast-supported, polymictic conglomerate is prominent in the lower portions of the Livingstone Creek Formation. Boulder- and cobble-sized clasts of grey granitic rocks and minor mafic plutonic and metamorphic rock clasts are set in a sparse matrix of coarse grey arkose or arkosic grit. Units of cross-bedded, grey arkose are locally interbedded with the conglomerate (Frarey 1977, p.21; Bennett 1981, p.7). The lithologies of the conglomerate clasts usually reflect that of the underlying rocks.

Microcline is the predominant feldspar in the matrix, along with lesser amounts of plagioclase. White mica, in a very fine matrix, forms from 5 to 20 percent in some specimens. Chlorite, pyrite, carbonate and opaque oxides are minor constituents.

In Duncan Township, up to 10 m of the uppermost part of the Livingstone Creek Formation are composed of a fine- to medium-grained pale grey to pale greenish-grey, well-sorted, massive quartz arenite which grades downward into grey arkose (Bennett 1977).

The clast size and local source of the conglomerates are consistent with those of alluvial fan deposits. The trough cross-bedded units may represent alluvial plain deposits.

THE DISTRIBUTION OF THE LIVINGSTONE CREEK FORMATION

In addition to the locations indicated by Frarey (1977), there is sufficient evidence to correlate some of the grey sandstones in the Dunns Valley area (Haughton, Otter, Morin and Galbraith townships) and in the Nicholas Township area with the Livingstone Creek Formation.

At Crazy Lake, in Nicholas Township, fine-grained, grey, cross-bedded, calcareous sandstones and polymictic conglomerates up to 150 m (500 feet) thick underlie a radioactive quartz-pebble conglomerate which, in turn, underlies Huronian volcanic rocks. The rock types and stratigraphic relationships at Crazy Lake are identical to those at Thessalon. Sprague (undated), Bennett (1978, p.105) and Bottrill (1971) have noted this similarity and suggested that the grey sandstones south of Crazy Lake be correlated with the Livingstone Creek Formation. The author does not agree (for reasons which will be made clear later in this discussion) with Roscoe's (1981, p.W12) suggestion that the conglomerates and arkoses at Crazy Lake are equivalent to the Ryan Member of the Matinenda Formation.

In the Quirke Lake syncline, east of Crazy Lake, the Livingstone Creek Formation is missing and Huronian volcanic rocks (where present) lie on Archean basement.

Examination of diamond-drill logs and drill core in the Sault Ste. Marie Drill Core Library indicates that the grey sandstones and conglomerates which underlie Huronian volcanic rocks and overlie Archean basement in the Dunns Valley area should be correlated with the Livingstone Creek Formation on the basis of stratigraphic position and lithological similarity.

In 1977, and again in 1989, the author examined relationships on the southern face of a steep hill 300 m (1000 feet) east and 450 m (1500 feet) south of the northeast corner of Lot 8, Concession 5, in Haughton Township. At this location, quartz-pebble conglomerates and arkosic grit and sandstone of the Matinenda Formation (Chandler 1976) directly overlie fine-grained, apple-green sandstone. This distinct green colouration fades to medium grey over a vertical distance of about 4 m (12 feet). Below this point, the grey sandstones are identical to those of the Livingstone Creek Formation. Chemical analyses of the bright green sandstone show the loss of soda and increase in potash typical of Huronian paleosols (Figure 11.2).

It was concluded that at this location, the Matinenda Formation lies disconformably upon the Livingstone Creek Formation. The Thessalon Formation is not present. It was assumed to have been removed during a period of pre-Matinenda erosion.

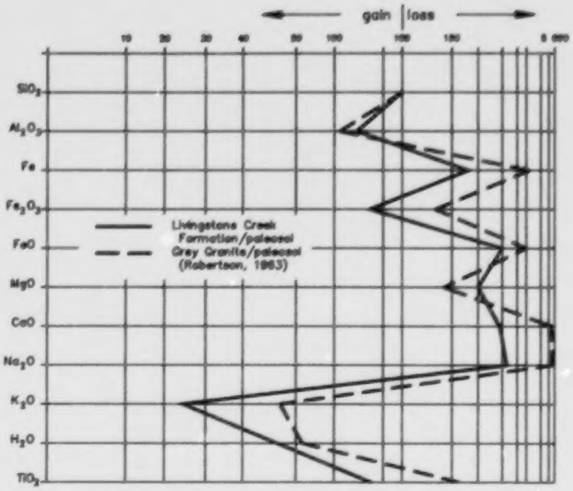


Figure 11.2.A gain and loss diagram for paleosol of the Livingstone Creek Formation compared with paleosol on granitic rocks.

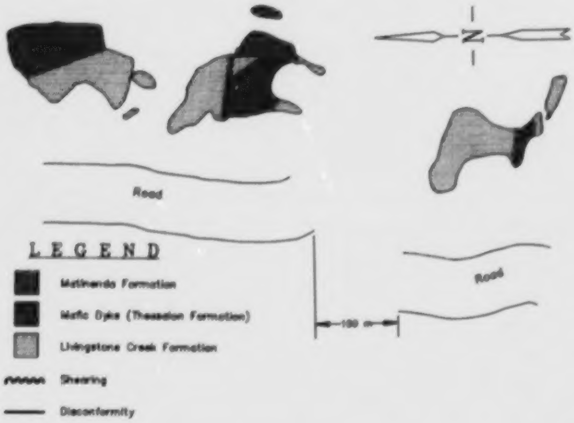


Figure 11.3.Mafic dikes (Thessalon Formation) intruding Livingstone Creek Formation, and disconformably overlain by Matinenda Formation.

About 600 m (2000 feet) northwest of the occurrence mentioned in the previous paragraph, the disconformity between the Matinenda Formation and the underlying green sandstones (paleosol of the Livingstone Creek Formation) is exposed on the east side of a timber haulage road. Here, a fine-grained, amygdaloidal, mafic dike, about 4 m wide, trends 090° and dips vertically in almost flat-lying greenish-grey sandstones considered to be equivalent to the Livingstone Creek Formation (Figure 11.3). Both contacts of the dike are sheared. It appears that the south side of the dike is a fault with north-side-down movement. In spite of the local displacement along the edges of the dike, it is clear that the dike does not intrude the overlying Matinenda Formation. Examination of thin sections indicate a change from a sericite-leucoxence assemblage at the top of the dike to a chlorite-sericite-leucoxene assemblage at the exposed base. This is consistent with a paleosol on mafic rocks.

A second, steeply dipping mafic dike about 2.5 m wide, intrudes almost flat-lying, cross-bedded, grey sandstones about 100 m south of the above location. This dike also displays a median amygdaloidal zone and sheared contacts. It is concluded that most of the shearing along the contacts of these dikes is due to the compaction of partially indurated sandstone around the less compressible dike.

STRATIGRAPHIC RELATIONSHIPS OF THE LIVINGSTONE CREEK FORMATION

The nature of the relationship between the Livingstone Creek Formation and the Matinenda Formation has been a point of contention for some time. Some authors consider the Livingstone Creek Formation to be the stratigraphic equivalent of the Matinenda Formation (Roscoe 1969, p.52; Frarey 1977, p.24; Robertson et al. 1969, p.19). The close association of the Livingstone Creek Formation with radioactive quartz-pebble conglomerate, and its basal stratigraphic position, supports this correlation. However, the following observations argue against it.

1. The relationships described in the previous section support the view that there is a significant erosion interval disconformity (the sub–Matinenda disconformity) between the Matinenda Formation and the Livingstone Creek Formation, and that there was a period of mafic igneous activity (Thessalon volcanism) within the Elliot Lake Group prior to this interval.
2. Radioactive and pyritic quartz-pebble conglomerates are not found within the Livingstone Creek Formation as indicated by Knight (1915) and Frarey (1977, p.21), but are discontinuous sedimentary units within, and directly below, the Thessalon Formation (Hay 1963, p.309; Bennett et al. 1975; Frarey 1977, p.21; Meyer 1983, p.260).
3. Most of the Livingstone Creek Formation bears very little physical resemblance to the Matinenda Formation: the sandstones of the former are relatively uniform in colour (grey) and grain size (fine to medium sand-sized), and lack quartz pebbles. The local presence of calcite on foreset beds seems to be a distinctive feature of the Livingstone Creek Formation. The yellow-green colour characteristic of the Matinenda Formation is lacking.
4. The Livingstone Creek Formation is overlain by Huronian volcanic rocks and rests on Archean basement. However, in the Elliot Lake area, there is no direct evidence of volcanic rocks overlying the Matinenda Formation. In contrast, the Matinenda Formation overlies Huronian volcanic rocks.

The Sub–Thessalon Disconformity

The following evidence is presented to argue the existence of an erosional disconformity between the Livingstone Creek Formation and the Thessalon Formation. Since a readily recognizable paleosol has not been found on the Livingstone Creek Formation, this evidence cannot be considered conclusive.

1. The top few metres of the Livingstone Creek Formation in the Sault Ste. Marie area are composed of fine-grained quartz arenite. The quartz grains in the quartz arenite are of the same general size range as those in the underlying grey sandstones of the underlying Livingstone Creek Formation.

The quartz arenite indicates a period of weathering and tectonic stability following the deposition of the Livingstone creek sands. The lack of this quartz arenite unit in most areas may indicate its removal by erosion.

2. Quartz-pebble conglomerates (locally pyritic and radioactive) lie directly on trough cross-bedded, fine-grained sandstones of the Livingstone Creek Formation at two known locations in the Thessalon area. The conglomerates rest on a planar surface, with no evidence of channeling or filling troughs in the underlying sands. Both conglomerates contain elevated gold contents (ca. 500 to 600 ppb, 0.02 ounces Au per ton; Bennett 1983, p.149). The abrupt change in rock type, the resistate components of the conglomerate, and the form of the contact, point to an erosional disconformity at these locations.

Huronian Volcanic Rocks

THE THESSALON FORMATION

The Thessalon Formation is predominantly fine- to medium-grained, dark grey, amygdaloidal basalt and very dark grey to almost black, andesite to rhyodacite, which lies above the Livingstone Creek Formation in the Thessalon, Aberdeen Township and Sault Ste. Marie areas (Frarey 1977).

The maximum thickness of the Thessalon Formation in the Sault Ste. Marie area is between 650 m (2000 feet) and 820 m (2500 feet) (Frarey 1977). In central Thessalon Township, a drill hole intersected 330 m (1000 feet) of volcanic rocks, although drilling on Lake Huron, south of Thessalon, intersected 670 m (2200 feet) of volcanic rocks and was in volcanic rocks when stopped. There are about 1200 m (3500 feet) in Aberdeen Township.

Discontinuous units of grey to pink, coarse arkose, grit and associated quartz-pebble conglomerate (pyritic and radioactive in part) form a distinctive assemblage, which is locally intercalated with flows near the base of the formation or found directly below the basal flow (Hay 1963; Bennett et al. 1976; Meyer 1983). The volcanic rocks in the Sault Ste. Marie and Aberdeen Township areas can be subdivided, in part, on the basis of "immobile" Ni, Cr, P_2O_5 and Ti contents into an upper, predominantly tholeiitic basalt, and lower complex or "mixed member", which includes basaltic andesite, tholeiitic andesite and rhyolite as well as tholeiitic basalt (Figures 11.4a, 11.4b). A magnesium-rich flow with pegmatoid patches and some of the chemical characteristics of komatiites are present near the base of the volcanic assemblage in the Thessalon area.

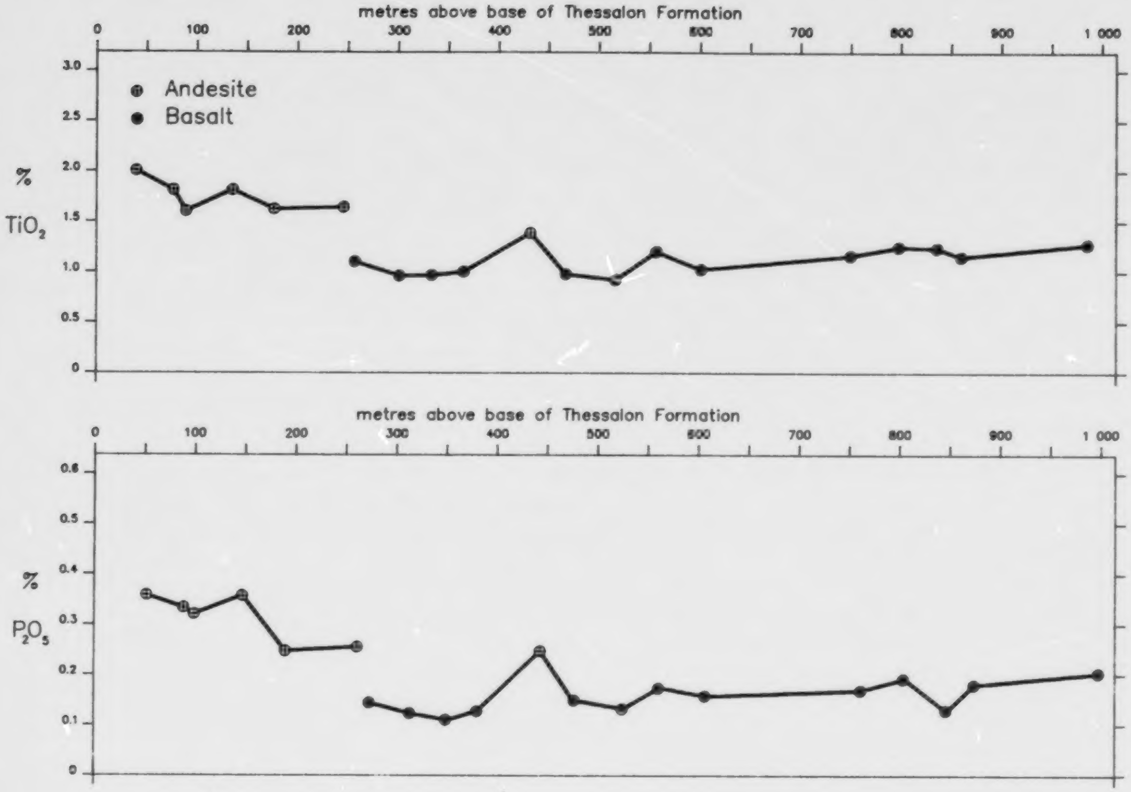


Figure 11.4.*Variation of P_2O_5 and TiO_2 with stratigraphic height, Thessalon Formation, Sault Ste. Marie.*

The upper basalts are almost uniformly greenish-grey, fine- to medium-grained tholeiitic metabasalt. The essential minerals are albite, actinolite, chlorite, clinozoisite, epidote and Fe-Ti oxides. Primary clinopyroxene is prominent in some thin sections of spilitic basalt from the Sault Ste. Marie area. The andesitic rocks commonly contain stilpnomelane and green mica in addition to albite and actinolite. Quartz is a minor component of basaltic and andesitic types. The metamorphic grade is sub-greenschist to lower greenschist.

Jolly (1987) carried out petrochemical studies of the Thessalon Formation in the Thessalon area and concluded that the mantle source of these volcanic rocks had a long and complex history involving either Archean subduction or mantle metasomatism.

The upper, mainly basaltic sequence of the Thessalon Formation appears to be mainly a continental flood basalt sequence, while the lower mixed member appears to have erupted from central vents.

HURONIAN VOLCANIC ROCKS OF THE QUIRKE LAKE SYNCLINE

The presence of Huronian volcanic rocks on Archean basement in the Quirke Lake syncline has been recognized for some time (Robertson 1971, p.5; Bottrill 1971). The development of a paleosol on Huronian volcanic rocks in the Elliot Lake area has been observed by Bennett (1978, p.106), Roscoe (1981, p.W12) and Meyer (*in* Little 1981, p.X13). Bennett (1978, p.106) states that there is no evidence of volcanism during, or after, the deposition of the Matinenda Formation.

On the north shore of Dollyberry Lake, and south of Crazy Lake, the volcanic rocks are predominantly medium grey to greenish-grey metabasalt. Some of these flows have high magnesia-low alumina contents. Between Dollyberry and Ten Mile lakes are several hawaiite and mugearite flows. These are medium-grey weathering and contain 5 to 10 percent euhedral albite phenocrysts a few millimetres long in a fine-grained groundmass.

Pyroclastic breccias occur in a Huronian volcanic complex between Ten Mile and Dollyberry lakes (Bennett 1978, p.107).

West of Pecors Lake, in Joubin Township, a thin unit of Huronian mafic flows lie on Archean greenstone terrane and are overlain by the Ryan Member of the Matinenda Formation (Robertson 1971, p.177). Some of these flows are high-magnesium basalts with pegmatoid areas, similar to those in the Thessalon and Dollyberry Lake area (unpublished data, Resident Geologist's

Files, Ministry of Northern Development and Mines, Sault Ste. Marie).

Since the Huronian stratigraphy at Crazy Lake is similar to that at Thessalon, the Dollyberry Lake volcanic rocks should be correlated with the Thessalon Formation (Bottrill 1971; Bennett 1978, p.105). The presence of high-magnesium basalts in the Thessalon, Dollyberry and Pecors lakes area is further evidence for this correlation.

The association of Livingstone Creek Formation, quartz-pebble conglomerate and Huronian volcanic rocks, occurring over widely separated areas between the Quirke Lake syncline and Sault Ste. Marie, suggests a regional control on the deposition of these units. Most of these areas are south of major thrust faults, which probably occupy the position of earlier normal faults (Zolnai et al. 1984). The present distribution of these units may be explained, either in terms of deposition controlled by major faults and scarps, or preservation from erosion of down-dropped fault blocks. The relationships in the Otter–Haughton area, and the evidence of disconformaties described above, suggest the present distribution and thickness of the Thessalon and Livingstone Creek formations represents erosional remnants rather than the original, much more extensive distribution.

The Matinenda Formation

About 30 m of fine-grained pink to yellowish-green subarkose was intersected in drill hole CW77-7 directly above the Thessalon Formation in the Thessalon area (Sault Ste. Marie Drill Core Library inventory, Resident Geologist's office, Assessment Files, Ministry of Northern Development and Mines, Sault Ste. Marie). This unit, which locally displays trough cross-bedding, is exposed on the east side of Highway 108 about 1 km north of Highway 17 and at a few locations between Highway 17 and Thessalon Point. The yellowish subarkose is overlain by a polymictic conglomerate, tentatively correlated by Frarey (1977, p.29) to the Ramsay Lake Formation. It is concluded, on the basis of stratigraphic position and lithological similarity, that the sandstones overlying the Thessalon Formation at Thessalon should be assigned to the Matinenda Formation. A similar sandstone at this stratigraphic position, mapped in the northern part of the Garden River Indian Reserve, was assigned to the Matinenda Formation by Bennett (1978).

Summary and Conclusions

1. The Matinenda Formation is not the stratigraphic equivalent of the Livingstone Creek Formation. An important period of Huronian volcanism and at least one significant period of erosion separates the two formations.
2. There are significant erosional disconformities below the Matinenda Formation and the Livingstone Creek Formaton.
3. All of the Huronian volcanic rocks of the Quirke Lake syncline are the stratigraphic equivalents of the Thessalon Formation. There is only one significant Huronian volcanic episode (Thessalon) in the western part of the Huronian belt.
4. The Matinenda Formation is locally present in the Thessalon and Sault Ste. Marie areas as a finer grained more distal sandstone.
5. The present distribution of the Livingstone Creek Formation and Thessalon Formation is largely the result of pre-Matinenda erosion and does not represent the original distribution of these rocks.

THE SAULT STE. MARIE DRILL CORE LIBRARY

by J.R. Walmsley

Permanent staff of the Sault Ste. Marie Drill Core Library presently includes J.R. Walmsley as Drill Core Library Geologist, and D. Messenger as Drill Core Library Assistant. D. Messenger completed a six-month training assignment at the end of February that involved the exchange of positions between himself and P. Morra, the Mining Claims Inspector. Temporary staff included Experience '89 summer assistant J. Nichols, who also served a three-month term as a co-op student (winter and spring of 1989). Other co-op students included S. Anderson (spring of 1989) and A. Borelli (fall of 1989).

During the year, the Drill Core Library reached its maximum storage capacity. In order to accommodate new donations, an outside core storage program was initiated to eliminate the need for telescoping of core and thus preserving the integrity of the drill holes. Core designated for outdoor storage has been selected primarily on the basis of redundant information and assay data.

During 1989, core from 54 holes, making a total of 16954 m, was collected by library staff. Core from the Wawa Resident Geologist's District totalled 1229 m; core from the Sault Ste. Marie Resident Geologist's District totalled 15725 m. The total inventory of the library is 84762 m, with 76390 m stored inside and 8372 m stored outside.

Significant contributions from the Sault Ste. Marie District were made by Rio Algom Limited, which donated core from 12 holes from the Stanleigh Mine in Elliot Lake (approximately 8855 m); P.L. Frankow from Neill Township, 257 m from 6 holes; Trow Ontario Ltd. from Plummer Additional, 94 m from 5 holes; and Locator Explorations Ltd. from Palmer and Ryan townships, 2081 m from 15 holes.

From the Wawa District, donations were from Cominco Ltd., Bruyere Township (762.5 m), and New Beginnings Resources Inc., West Township (257.9 m); both townships are in the Missanabie–Dog Lake area.

Donations this year exceeded last year by over 7500 m. The 1990 plans for the core library staff target the Mishibishu Lake area and the Batchawana area for donations of core from the active companies. Anyone wishing to donate core may contact the appropriate Resident Geologist's office or the Drill Core Library.

Use of the facility by government personnel, independant prospectors and company representatives was about equal with 1988. Anyone wishing to view core should notify the library in advance to insure that core stored outside can be brought to the facility. Inventory catalogues can be obtained by contacting the Resident Geologist's office or the Drill Core Library.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

During 1989, the Geophysics/Geochemistry Section of the Ontario Geological Survey let contracts for the field survey portion of airborne geophysical surveys over five areas of Ontario. One of these surveys was carried out in the Batchawana area. It included all of the early Precambrian metavolcanic-metasedimentary rocks of the Batchawana greenstone belt and the area of Keweenawan rocks in the Mamainse Point area. The electromagnetic and magnetic data were obtained using the AERODAT system, owned and operated by Aerodat Limited.

The flight lines, anomalies, and magnetic contours will be presented on a photomosaic base at a scale of 1:20000 with an appropriate legend. Technical information regarding these geophysical surveys is available in Barlow (1989).

J. Fortescue continued geochemical mapping in the Batchawana greenstone belt during the summer of 1989. The aim of these surveys is to provide a regional geochemical map of the entire Batchawana greenstone belt using standardized methodology.

The area of the 1989 survey included the townships of Wlasy, Bracci, Gapp, Gaudry, Lunkie, Nahwegezic and the northern halves of Hynes and Lamming townships. A total of 905 samples of pre-*Ambrosia* lake sediments core material was collected from this 730 km² area. Results from the chemical analyses for 35 elements are expected in March 1990. A geochemical map will be released upon completion.

Technical information regarding this survey and lake sediment geochemical surveys in general can be obtained in Fortescue et al. (1989, p.255, 259).

Lightfoot et al. (1989, p.265-274) presented preliminary field information for a suite of 108 samples of Keweenawan volcanic rocks from the Mamainse Point area, about 70 km north of Sault Ste. Marie. The work is part of a study of interflow variation on a detailed scale using petrogenetically significant elements (e.g., Y, Zr, Cs, Th, Ta, Hf, U, Nb, Rb, Sr and rare earth elements).

SELECTED PUBLICATIONS RECEIVED

Berg, J.H. and Klewin, K.W. 1988. High MgO lavas from the Keweenawan midcontinent rift near Mamainse Point, Ontario; Geology, v.16, p.1003-1006.

Chandler, F.W. 1988a. Diagenesis of sabkha-related sulphate nodules in the early Proterozoic Gordon Lake Formation, Ontario, Canada; Carbonates and Evaporites, v.3, no.1, p.75-94.

—— 1988b. Quartz arenites: review and interpretation; Sedimentary Geology, v.58, p.105-126.

Fralick, P.W. and Miall, A.D. 1987. Glacial outwash uranium placers? Evidence from the lower Huronian Supergroup, Ontario, Canada; International Atomic Energy Agency, Technical Document 427, p.133-154.

G-Farrow, C. and Mossman, D.J. 1988. Geology of Precambrian paleosols at the base of the Huronian Supergroup, Elliot Lake, Ontario; Precambrian Resources, v.42, p.107-139.

Harker, R.I. and Giegengack, R. 1989. Brecciation of clasts in diamictites of the Gowganda Formation, Ontario, Canada; Geology, v.17, p.123-126.

Holt, A.R. 1988. The use of uranium and coal at Ontario Hydro; Canadian Institute of Mining and Metallurgy Bulletin, v.81, p.39-42.

Ifill, R.O., Clark, A.H. and Cooper, W.C. 1989. Mineralogical and process controls on the oxidative acid-leaching of radioactive phases in Elliot Lake, Ontario, uranium ores: I-uraninite, uranothorite and monazite; Canadian Institute of Mining and Metallurgy Bulletin, v.82, no.925, p.65-74.

Jolly, W.T. 1987. Lithophile elements in Huronian low-Ti continental tholeiites from Canada, and evolution of the Precambrian mantle; Earth and Planetary Science Letters, v.85, p.401-415.

Marmont, S. 1988. Ore deposit models #13. Unconformity-type uranium deposits; Geoscience Canada, v.14, no.4, p.219-229.

Palmer, J., Phillips, G.N. and McCarthy, T.S. 1989. Paleosols and their relevance to Precambrian atmospheric composition; Journal of Geology, v.97, p.77-92.

Young, G.M. 1988. Proterozoic plate tectonics, glaciation, and iron formation; Sedimentary Geology, v.58, p.127-144.

REFERENCES

Barlow, R.B. 1989. Recent airborne electromagnetic-magnetic surveys in northern Ontario; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.234-236.

Bennett, G. 1977. Garden River Indian Reserve area, District of Algoma; *in* Summary of Field Work 1977, Ontario Geological Survey, Miscellaneous Paper 75, p.104-106.

—— 1978. Huronian volcanism, districts of Algoma and Sudbury; *in* Summary of Field Work 1978, Ontario Geological Survey, Miscellaneous Paper 82, p.105-111.

—— 1981. The Huronian rocks between Sault Ste. Marie and Thessalon, District of Algoma, a field excursion guide; Institute of Lake Superior Geology, 42p.

—— 1983. 1982 Report of the Sault Ste. Marie Resident Geologist; *in* Report of Activities, Regional and Resident Geologists 1982, Ontario Geological Survey, Miscellaneous Paper 107, p.141-151.

Bennett, G., Hillier, R.D., Nentwich, F., Dupuis, C.P. and Pucovsky, M. 1975. Jarvis Lake–Garden River area, District of Algoma; Ontario Division of Mines, Preliminary Map P.1064, scale 1:15 840.

Bennett, G., Sawitsky, E. and Whittaker, P. 1976. Jarvis Lake–Duncan Township area, District of Algoma; Ontario Division of Mines, Preliminary Map P.1190, scale 1:15 840.

Bottrill, T.J. 1971. Uraniferous conglomerates of the Canadian Shield; *in* Report of Activities, Part A: April to October, 1970, Geological Survey of Canada, Paper 71-7, p.77-83.

Chandler, F.W. 1976. Geology of the Saunders Lake area, District of Algoma; Ontario Division of Mines, Geological Report 155, 46p.

Fortescue, J.A.C., Vidas, E. and Nakashima A. 1989. Regional geochemical mapping in the Batchawana greenstone belt; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.254-259.

Frarey, M.J. 1967. Three new Huronian names; Geological Survey of Canada, Paper 67-6, 3p.

—— 1977. Geology of the Huronian belt between Sault Ste. Marie and Blind River, Ontario; Geological Survey of Canada, Memoir 383.

Hay, R.E. 1963. The geology of the Sault Ste. Marie map area; unpublished PhD thesis, McGill University, Montreal, 325p.

Jolly, W.T. 1987. Lithophile elements in Huronian low-Ti continental tholeiites from Canada, and evolution of the Precambrian mantle; Earth and Planetary Science Letters, v.85, p.401-415.

Knight, C.W. 1915. The north shore of Lake Huron; Ontario Bureau of Mines, Annual Report, 1915, v.24, pt.1, p.216-241.

Lightfoot, P.C., Doherty, W. and Sutcliffe, R.H. 1989. Precise determination of trace element abundances in basalts from the Black Bay Peninsula and Mamainse Point sections of the Keweenawan volcanic pile using inductively coupled plasma-mass spectrometry; *in* Summary of Field Work and Other Activities 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.265-274.

Little, W.H. 1981. Genesis of Canadian uraniferous quartz-pebble conglomerate ores; *in* Genesis of Uranium and Gold-bearing Precambrian Quartz-pebble Conglomerates, United States Geological Survey, Professional Paper 1161A-BB, p.X1-X14.

Meyer, W. 1983. Lower Huronian gold: an investigation of quartz-clast conglomerates between Sault Ste. Marie and Elliot Lake; *in* Summary of Field Work 1983, Ontario Geological Survey, Miscellaneous Paper 116, p.259-262.

Robertson, J.A. 1971. A review of recently acquired geological data, Blind River–Elliot Lake area; *in* Huronian Stratigraphy and Sedimentation, Geological Association of Canada, Special Paper Number 12, 35p.

Robertson, J.A., Frarey, M.J. and Card, K.D. 1969. The Federal-Provincial committee on Huronian stratigraphy: progress report; Ontario Department of Mines and Northern Affairs, Miscellaneous Paper 31, 26p.

Roscoe, S.M. 1969. Huronian rocks and uraniferous conglomerates; Geological Survey of Canada, Paper 68-40, 205p.

—— 1981. Temporal and other factors affecting deposition of uraniferous conglomerates; *in* Genesis of Uranium and Gold-bearing Precambrian Quartz-pebble Conglomerates, United States Geological Survey, Professional Paper 1161 A-BB, p.W1-W17.

Sprague, D. (undated). Peg-Hecla claims , Twp. 163, NTS 41 J/10; unpublished report for Rio Tinto Canadian Exploration Limited, 7p.

Zolnai, A.I., Price, R.A. and Helmstaedt, H. 1984. Regional cross-section of the Southern Province adjacent to Lake Huron, Ontario; amplications for the tectonic significance of the Murray fault zone; Canadian Journal of Earth Sciences, v.21, p.447-456.

12. Timmins Resident Geologist's District—1989

L.E. Luhta[1], P. Sangster[2], J. Ireland[2], C. Hamblin[3] and M. Bradshaw[4]

[1]Resident Geologist, Timmins Resident Geologist's Office, Northeastern Region.

[2]Staff Geologist, Timmins Resident Geologist's Office, Northeastern Region.

[3]Drill Core Library Geologist, Timmins Drill Core Library, Northeastern Region.

[4]Geological Assistant, Timmins Resident Geologist's Office, Northeastern Region.

INTRODUCTION

The Ministry of Northern Development and Mines commissioned a survey of exploration expenditures in the Northeastern Region. Results of this study indicate that there has been a 48 percent drop in expenditures from 1988 to 1989. A number of factors contributed to the decline in exploration and development activity in the Timmins Resident Geologist's District during 1989. Chief among these were the low price of gold, the changes to flow-through funding and a general lack of confidence in speculative mining stocks.

Sustained high base metal prices led to continued interest in base metal exploration by the major companies.

Although the majority of Advanced Development Projects reported in the *Report of Activities 1988, Resident Geologists* have suspended operations, during 1989 there were 17 producing mine operations in the Timmins Resident Geologist's area.

Three mines were opened and three mines were closed.

The Redstone Nickel Mine in Eldorado Township, the St. Andrew Goldfields Mine in Stock Township and the Giant Yellowknife Mines Limited No. 5 pit in Whitney Township were brought into production. Operations ceased at the Giant Yellowknife Mines Limited Timmins property, at the Owl Creek open pit in Hoyle Township held by Falconbridge Gold Corp., and at the Asarco Exploration Ltd.'s Aquarius Mine in Macklem Township.

CLAIM STAKING ACTIVITY

From January 1 to November 1, 1989, there were 3901 claims recorded in the Porcupine Mining Division as compared to 5695 claims recorded during that same time period in 1988. The drop in claim staking reflects the general decrease in mining exploration activity, which is further exemplified by the sharp drop in the number of active claims in the division. There are currently 27808 active claims in the division as compared to 33337 active claims at the end of December 1988.

INCENTIVES PROGRAMS

ONTARIO MINERAL EXPLORATION PROGRAM (OMEP)

The Ontario Mineral Exploration Program (OMEP) was officially completed on December 31, 1988. An additional six-month period was given to allow companies to complete previously submitted applications. Six programs in the Porcupine Mining Division received assistance from OMEP totalling $126300 from eligible expenditures of $505200 during 1989.

ONTARIO PROSPECTORS ASSISTANCE PROGRAM (OPAP) AND ONTARIO MINERAL INCENTIVE PROGRAM (OMIP)

In October 1989, the Ontario Ministry of Northern Development and Mines announced two new incentive programs. By providing part of the risk capital to individuals and to junior mining companies, these programs are designed to promote prospecting and the discovery of new mineral deposits.

The Timmins Resident Geologist's client group has shown a high degree of interest in both programs. M.A. Tremblay, a Timmins area prospector, was given the first OPAP grant on October 19, 1989. Maximum assistance under OPAP is $10000 per year with only one grant per prospector per year allowed. Maximum assistance under OMIP is $150000 per applicant per year.

At the end of November 1989, 20 applications for OPAP grants in the Timmins Resident Geologist's area had been approved. This represents a total figure of $167296 awarded.

MINING ACTIVITY—OPERATING MINES 1989

BASE METALS

Falconbridge Limited, Kidd Creek Mine

Although complete figures were not available at the time of writing, estimated production to the end of 1989 was 4.1 million tonnes from the No. 1 and No. 2 mines. Grades for 1989 production were 56 g/t Au, 3.1 percent Cu and 5.1 percent Zn.

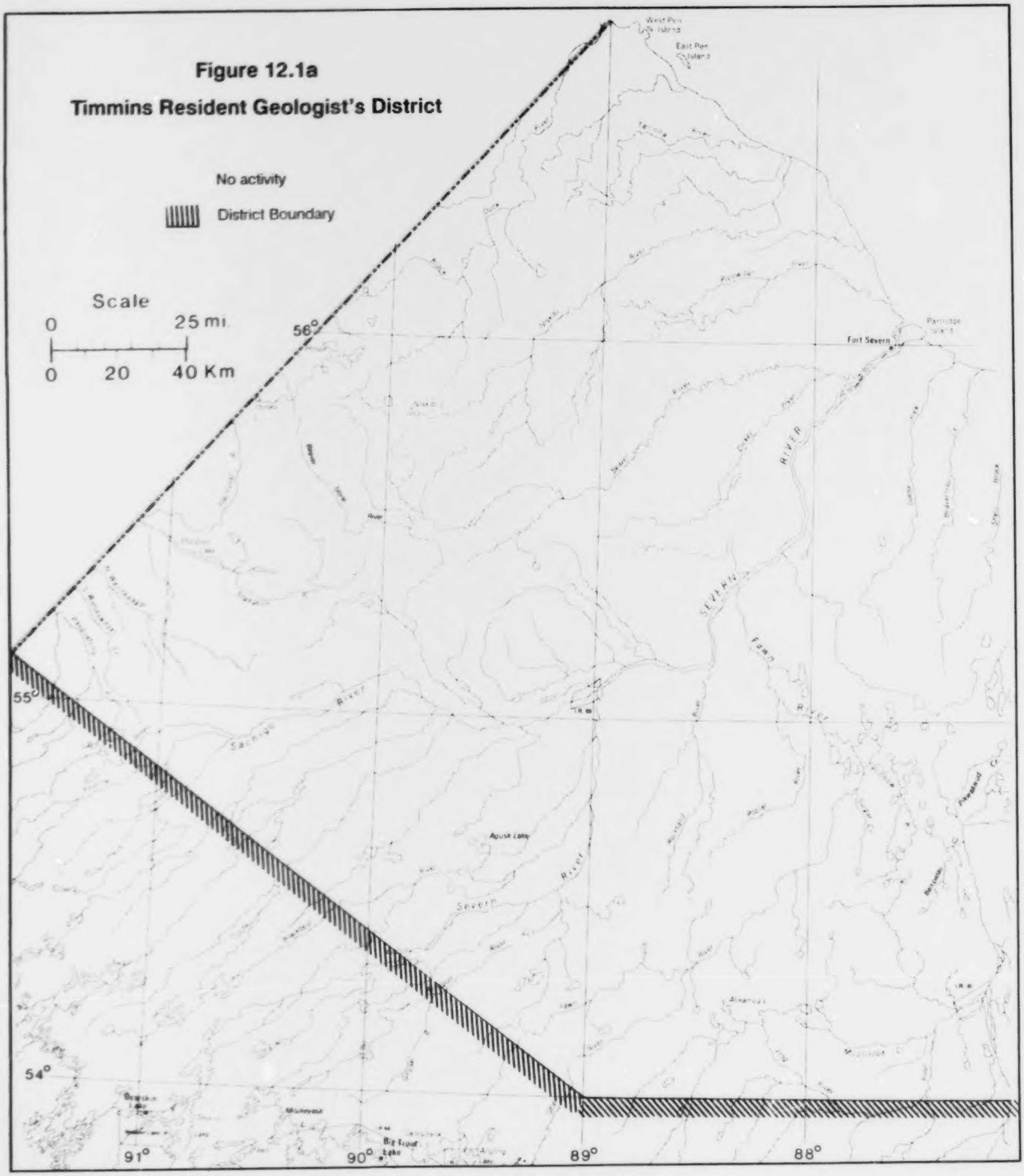


Figure 12.1a

Timmins Resident Geologist's District

No activity
District Boundary
Scale
0
25 mi
0
20
40 Km
West Pen Island
East Pen Island
Partridge Island
Fort Severn
SEVERN
RIVER
Fawn
River
Sachigo
River
Severn
River
Agusk Lake
Big Trout Lake
56°
55°
54°
91°
90°
89°
88°

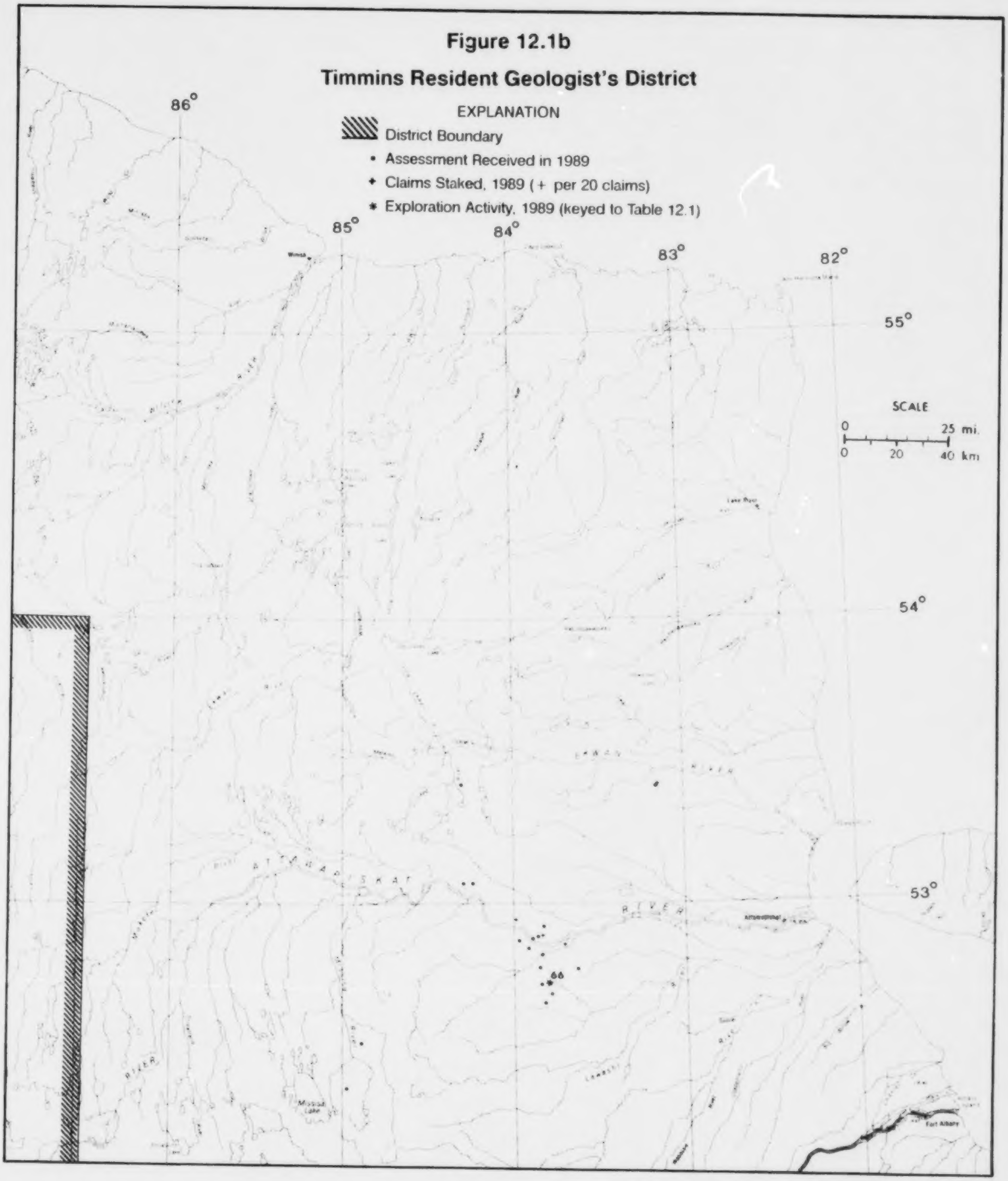


Figure 12.1b

Timmins Resident Geologist's District

EXPLANATION
▨ District Boundary
• Assessment Received in 1989
✦ Claims Staked, 1989 (+ per 20 claims)
✱ Exploration Activity, 1989 (keyed to Table 12.1)
86°
85°
84°
83°
82°
55°
54°
53°
SCALE
0 25 mi.
0 20 40 km
EKWAN RIVER
ATTAWAPISKAT RIVER
RIVER
66
Missisa Lake
Fort Albany

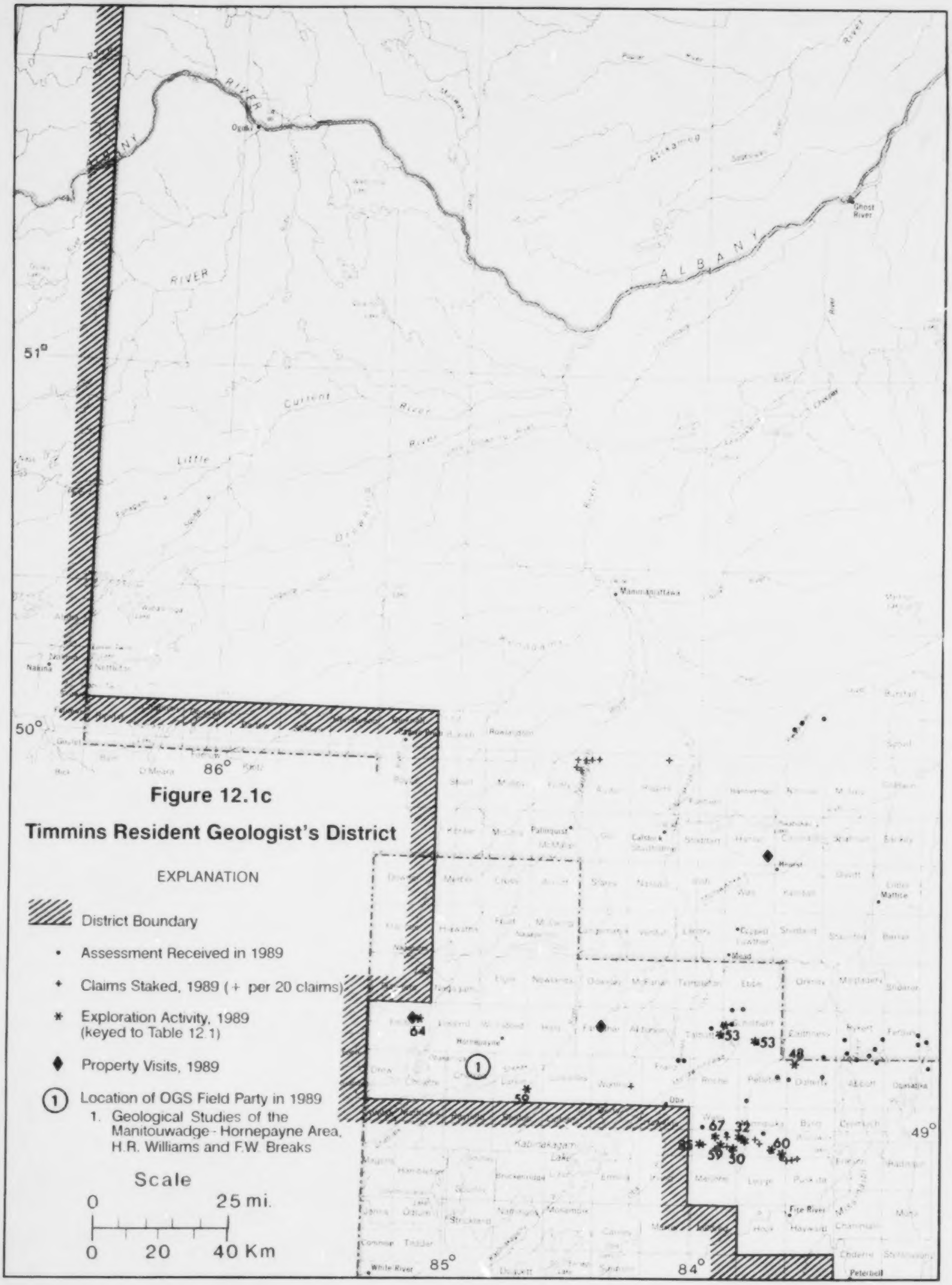


Figure 12.1c

Timmins Resident Geologist's District

EXPLANATION
▨ District Boundary
• Assessment Received in 1989
+ Claims Staked, 1989 (+ per 20 claims)
* Exploration Activity, 1989 (keyed to Table 12.1)
♦ Property Visits, 1989
① Location of OGS Field Party in 1989
1. Geological Studies of the Manitouwadge - Hornepayne Area, H.R. Williams and F.W. Breaks
Scale
0
25 mi.
0
20
40 Km
ALBANY RIVER
ALBANY
RIVER
Ogoki
Ghost River
Attawapiskat
Current
River
Little
River
Nakina
Mammamattawa
Hornepayne
Hearst
Mattice
Mead
Oba
Kabinakagami Lake
Fire River
White River
Peterbell
51°
50°
86°
85°
84°
49°
64
59
53
53
48
67
32
55
59
50
60

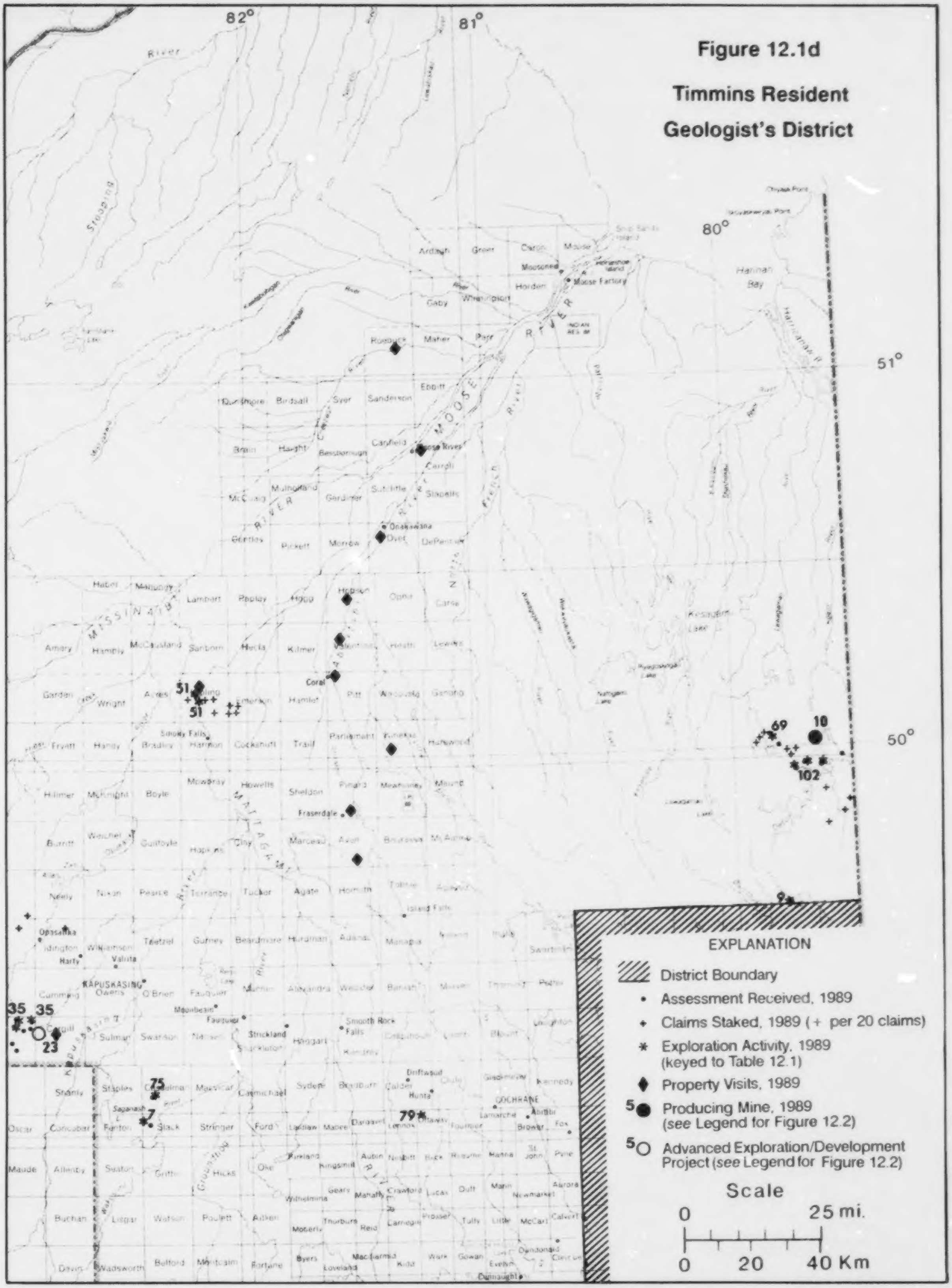


Figure 12.1d

Timmins Resident Geologist's District

82°
81°
80°
51°
50°
River
Moose River
Missinaibi River
Mattagami River
Groundhog River
Abitibi River
French River
Harricanaw R.
Hannah Bay
Kesagami Lake
Moosonee
Moose Factory
Onakawana
Coral
Fraserdale
Smooth Rock Falls
Island Falls
Kapuskasing
Opasatika
Mattice
Cochrane
Strickland
Driftwood
Hunta
Sulman
Swanson
Staples
Stringer
Ford
Carmichael
EXPLANATION
District Boundary
Assessment Received, 1989
Claims Staked, 1989 (+ per 20 claims)
Exploration Activity, 1989 (keyed to Table 12.1)
Property Visits, 1989
Producing Mine, 1989 (see Legend for Figure 12.2)
Advanced Exploration/Development Project (see Legend for Figure 12.2)
Scale
0
25 mi.
0
20
40 Km
51
69
10
102
35
23
75
7
79

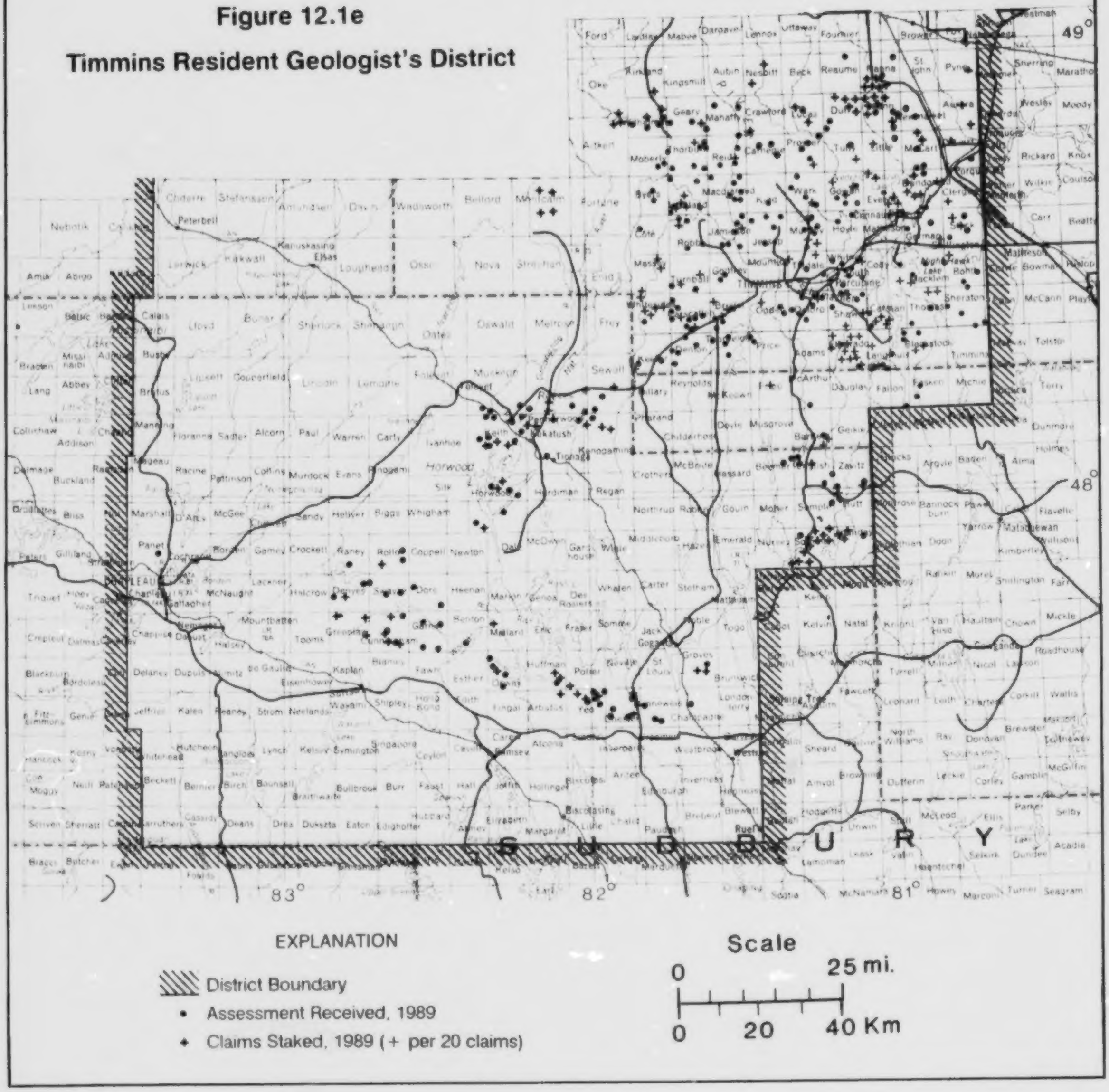

49°
48°
83°
82°
81°
S U D B U R Y
EXPLANATION
▨ District Boundary
• Assessment Received, 1989
✦ Claims Staked, 1989 (+ per 20 claims)
Scale
0
25 mi.
0
20
40 Km

Figure 12.1e

Timmins Resident Geologist's District

Figure 12.1f

Timmins Resident Geologist's District

EXPLANATION

* Exploration Activity, 1989 (keyed to Table 12.1)

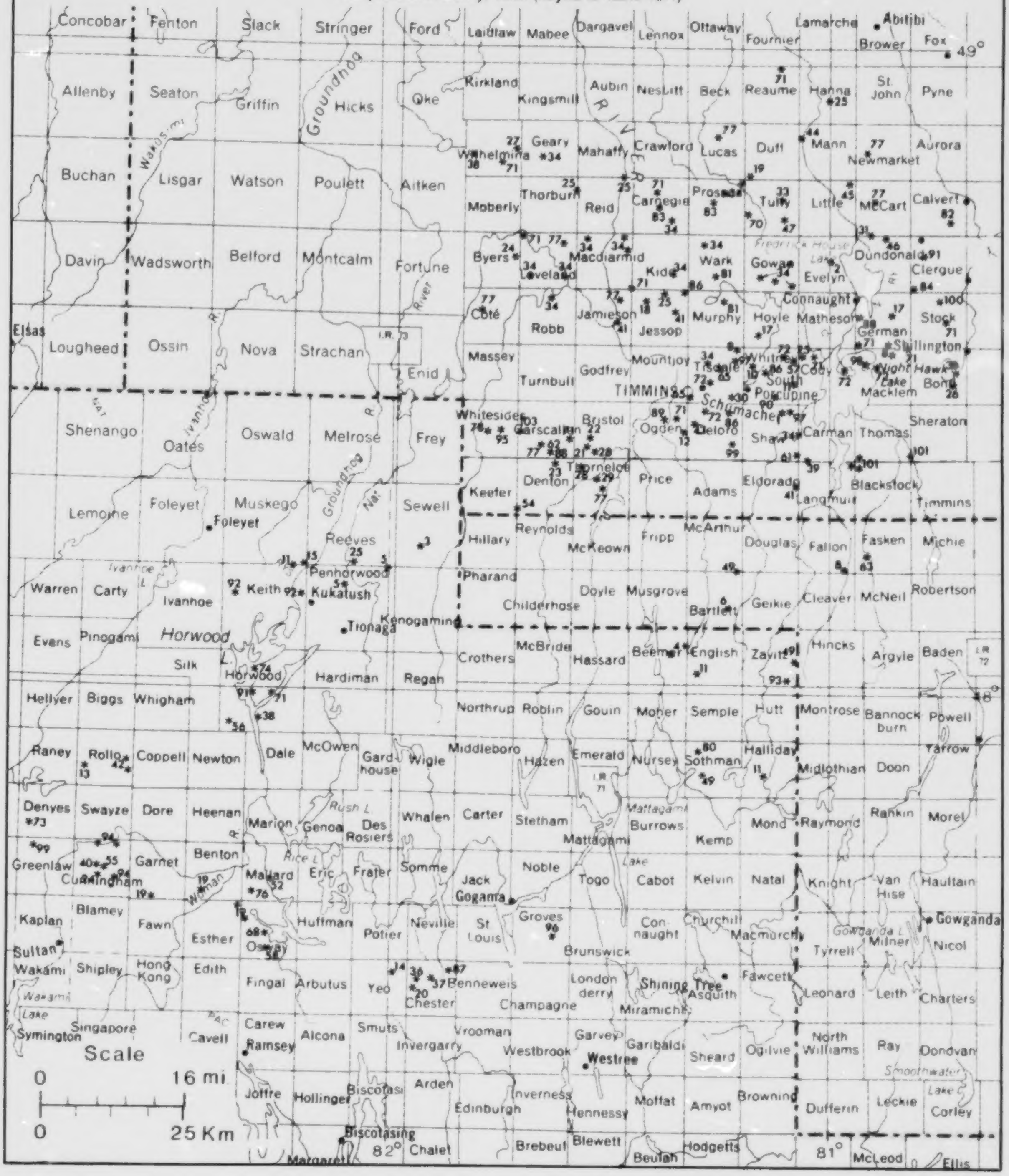

Concobar
Fenton
Slack
Stringer
Ford
Laidlaw
Mabee
Dargavel
Lennox
Ottaway
Fournier
Lamarche
Abitibi
Brower
Fox
49°
Allenby
Seaton
Griffin
Hicks
Oke
Kirkland
Kingsmill
Aubin
Nesbitt
Beck
Reaume
Hanna
St. John
Pyne
Groundhog
Buchan
Lisgar
Watson
Poulett
Aitken
Wilhelmina
Geary
Mahaffy
Crawford
Lucas
Duff
Mann
Newmarket
Aurora
Moberly
Thorburn
Reid
Carnegie
Prosser
Tully
Little
McCart
Calvert
Davin
Wadsworth
Belford
Montcalm
Fortune
Byers
Loveland
Macdiarmid
Kidd
Wark
Gowan
Evelyn
Dundonald
Clergue
Frederick House Lake
Elsas
Lougheed
Ossin
Nova
Strachan
I.R. 73
Côté
Robb
Jamieson
Jessop
Murphy
Hoyle
Connaught
Matheson
German
Stock
Shillington
Massey
Enid
Turnbull
Godfrey
Mountjoy
TIMMINS
Tisdale
Whitney
South Porcupine
Cody
Night Hawk Lake
Bond
Macklem
Schumacher
Shenango
Oates
Oswald
Melrose
Frey
Whitesides
Carscallen
Bristol
Ogden
Deloro
Shaw
Carman
Thomas
Sheraton
Denton
Thornelos
Price
Adams
Eldorado
Langmuir
Blackstock
Timmins
Lemoine
Foleyet
Muskego
Sewell
Keefer
Reynolds
Foleyet
McArthur
Hillary
McKeown
Fripp
Douglas
Fallon
Fasken
Michie
Reeves
Penhorwood
Pharand
Warren
Carty
Ivanhoe L.
Ivanhoe
Keith
Kukatush
Doyle
Musgrove
Childerhose
Bartlett
Geikie
Cleaver
McNeil
Robertson
Evans
Pinogami
Horwood
Tionaga
Kenogaming
Crothers
McBride
Hassard
Beemer
English
Zavitz
Hincks
Argyle
Baden
I.R. 72
Silk
Horwood L.
Hardiman
Regan
Hellyer
Biggs
Whigham
Northrup
Roblin
Gouin
Mohler
Semple
Hutt
Montrose
Bannockburn
Powell
48°
Raney
Rollo
Coppell
Newton
Dale
McOwen
Gardhouse
Wigle
Middleboro
Hazen
Emerald
Nursey
Sothman
Halliday
Midlothian
Doon
Yarrow
I.R. 71
Denyes
Swayze
Dore
Heenan
Rush L.
Marion
Genoa
Des Rosiers
Whalen
Carter
Stetham
Mattagami
Burrows
Kemp
Mond
Raymond
Rankin
Morel
Greenlaw
Garnet
Benton
Rice L.
Mallard
Eric
Frater
Somme
Noble
Mattagami Lake
Cunningham
Jack
Gogama
Togo
Cabot
Kelvin
Natal
Knight
Van Hise
Haultain
Kaplan
Blamey
Fawn
Esther
Huffman
Potier
Neville
St Louis
Groves
Connaught
Churchill
Macmurchy
Gowganda L.
Gowganda
Sultan
Osway
Brunswick
Tyrrell
Milner
Nicol
Wakami
Shipley
Hong Kong
Edith
Fingal
Arbutus
Yeo
Chester
Benneweis
Champagne
London derry
Shining Tree
Asquith
Miramichi
Fawcett
Leonard
Leith
Charters
Wakami Lake
Symington
Singapore
Cavell
Carew
Ramsey
Alcona
Smuts
Invergarry
Vrooman
Westbrook
Garvey
Westree
Garibaldi
Sheard
Ogilvie
North Williams
Ray
Donovan
Smoothwater
Scale
0
16 mi
0
25 Km
Joffre
Hollinger
Biscotasi
Arden
Edinburgh
Inverness
Hennessy
Moffat
Amyot
Browning
Dufferin
Leckie
Lake Corley
Corley
Biscotasing
Margaret
82°
Chalet
Brebeuf
Blewett
Beulah
Hodgetts
81°
McLeod
Ellis

TABLE 12.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	AJM Metals Ltd.	Shaw, Whitney--magnetic, electromagnetic and very low frequency electromagnetic surveys
2	R.E. Allerston	Evelyn--magnetic and very low frequency electromagnetic survey
3	American Barrick Resources Corporation	Sewell--geological survey, sampling, diamond drilling
4	American Barrick/HSK Minerals	Beemer, English--diamond drilling
5	American Barrick/Glen Auden/Goldrock	Penhorwood--geological survey, diamond drilling, sampling
6	J.R. Arengi	Bartlett--geochemical survey, diamond drilling, assaying
7	J. Arseneault	Slack--manual labour
8	Asarco Exploration Company of Canada	Fallon, German, Macklem--diamond drilling Tisdale--sampling
9	Aurogin Resources Ltd.	North Chabbie Lake--diamond drilling
10	Belmoral Mines Ltd.	Whitney--diamond drilling
11	BHP-Utah Mines Limited	Whitney--magnetic, very low frequency electromagnetic and induced polarization surveys Keith, Muskego--diamond drilling, assaying English, Halliday--geological, magnetic and pulse electromagnetic surveys
12	Black Cliff Mines Ltd.	Ogden--geological survey, diamond drilling
13	Black Gregor Explorations/Carlson Mines	Rollo--diamond drilling
14	Blue Falcon Mines Ltd.	Yeo--stripping
15	B. P. Canada Incorporated	Muskego, Keith, Reeves, Penhorwood--geological, geochemical and airborne magnetic and electromagnetic surveys
17	Canamax Resources Incorporated	German--geological survey Hoyle--diamond drilling
18	Canhorn Mining Corporation	Jessop--horizontal loop electromagnetic survey
19	Central Crude Limited	Duff--induced polarization/resistivity survey, diamond drilling
19	Central Crude/Noront Resources	Osway--airborne magnetic, electromagnetic and very low frequency electromagnetic surveys, ground geophysical and geochemical surveys Benton, Esther--airborne geophysical surveys Garnet--geological and airborne geophysical surveys, sampling
20	Chester Minerals Limited	Chester--diamond drilling
21	Chevron Canada Resources Ltd.	Bristol--magnetic survey
22	Chevron Canada Resources Ltd.	Bristol--diamond drilling, assaying
23	E. Colbert	Denton--diamond drilling, assaying
24	Cominco Limited	Byers--geophysical surveys Cunningham--geological survey
25	Comstate Resources Limited	Jessop, Reid, Mahaffy, Carnegie, Thorburn--magnetic and horizontal loop electromagnetic surveys Hanna--geological survey Reeves, Cody--electromagnetic survey
26	Cross Lake Minerals Limited	Bond--magnetic and very low frequency electromagnetic surveys
27	Cross Lake Minerals/Teck Corporation	Wilhelmina--magnetic and horizontal loop electromagnetic surveys, diamond drilling
28	J.E. Croxall	Bristol--stripping Thorneloe--magnetic and very low frequency electromagnetic surveys
29	J.E. Croxall/Mintek Resources Ltd.	Thorneloe--diamond drilling, assaying
30	Diepdaume Mines Limited	Tisdale--shaft rehabilitation
31	Ebony Gold Mines	Dundonald, McCart--diamond drilling
32	Ekersval Resources Ltd.	Minnipuka, Walls--magnetic, horizontal loop electromagnetic, geological and geochemical surveys, diamond drilling
33	Esso Minerals Canada	Tully--magnetic survey
34	Falconbridge Limited	Kidd, Wark, Carman, Shaw, Carnegie, Geary--magnetic and horizontal loop electromagnetic surveys Gowan--overburden drilling Loveland, Macdiarmid--magnetic and horizontal loop electromagnetic surveys, diamond drilling Robb, Tisdale, Prosser-diamond drilling
35	Fiedmont Resources Ltd.	Parnell, Ecclestone--diamond drilling
36	Glen Roy Resources Incorporated	Chester--diamond drilling
37	Gold Bar Res./Murgold Resources	Chester--diamond drilling
38	Golden Dragon Resources Limited	Bond--magnetic and electromagnetic surveys Horwood--geological survey, sampling Wilhelmina--magnetic and horizontal loop electromagnetic surveys
39	Golden Pheasant Resources Incorporated	Langmuir, Carman--diamond drilling

TABLE 12.1. CONTINUED.

Number on Figure	Individual or Company	Activity
40	Grand American Minerals Limited	Cunningham--geochemical and geological surveys
41	Granges Exploration Ltd.	Eldorado--geological, magnetic and horizontal loop electromagnetic surveys, trenching Jessop--linecutting, electromagnetic survey, diamond drilling and assaying Jamieson--horizontal loop electromagnetic survey
42	Hanson Lake Resources Limited	Rollo--diamond drilling and assaying
43	Fred Harvey	Deloro--manual and trenching
44	L. Hill	Mann--prospecting, sampling
45	H.L. Mineral Holdings/Aurizon Mines	Little--diamond drilling
46	H.L. Mineral Holdings/Ebony Mines	Dundonald--magnetic and horizontal loop electromagnetic surveys
47	Homestake Mining Co.	Tully--magnetic and horizontal loop electromagnetic surveys
48	HSK Minerals Limited	Caithness, Doherty, Pelletier--stripping, trenching
49	Inco Exploration & Technical Services Inc.	Bartlett, McArthur--stripping, trenching, sampling Semple, Sothman--geological survey Zavitz--geological, magnetic and electromagnetic surveys,trenching, sampling
50	Ingamar/M. Hibbard	Walls--beneficiation studies
51	James Bay Kaolin Corporation	Kipling, Emerson--sonic drilling
52	Jarvis Resources Limited	Mallard--diamond drilling, induced polarization survey
53	Kaphearst Resource Corporation	Scholfield, Talbott--diamond drilling
54	Keefer Lake Resources	Keefer, Denton--geological and magnetic surveys
55	Kirkton Resources Limited	Cunningham--geological survey, sampling
56	J.A. Landers	Horwood--stripping, trenching
57	Lithium Corporation of Canada Ltd., The	Whitney--magnetic and very low frequency electromagnetic surveys
58	MacJo Resources Limited	Osway--diamond drilling, magnetic survey
59	Manridge Explorations Limited	Walls--airborne magnetic and very low frequency electromagnetic surveys Larkin--geological survey
60	Markbridge Resources Ltd.	Minnipuka--magnetic, horizontal loop electromagnetic, Slingram electromagnetic, geological and geochemical surveys, diamond drilling, sampling
61	Marshall Minerals Corporation	Shaw--diamond drilling
62	H. McKenzie	Carscallen--stripping, manual and mechanical labour
63	D. Meunier	Fasken--geological survey
64	W. Miller	Foch--prospecting, stripping
65	Moneta Porcupine Mines Inc.	Tisdale--diamond drilling, sampling
66	Monopros Ltd.	Area 526-834--magnetic survey
67	Montval Resources Ltd.	Walls--magnetic, very low frequency and horizontal loop electromagnetic surveys
68	Muscocho Explorations Limited	Osway--magnetic and very low frequency electromagnetic surveys
69	Newmont Exploration of Canada Limited	Sunday Lake Area--magnetic survey
70	New Texmont Exploration Limited	Tully--diamond drilling
71	Noranda Exploration Company, Limited	Macklem, Cody, Stock--diamond drilling Ogden--geological survey, diamond drilling Loveland--geophysical surveys Macdiarmid, Jessop, Jamieson, Carscallen, Reaume, Fournier, Wilhelmina, Carnegie--magnetic and horizontal loop electromagnetic surveys German--magnetic survey Horwood--geological survey, stripping, sampling, assaying
72	Pamorex Minerals Incorporated	Cody--magnetic and very low frequency electromagnetic surveys, surface and underground diamond drilling Deloro--surface and underground diamond drilling, stripping and sampling Tisdale, Whitney--underground diamond drilling Macklem--magnetic and very low frequency electromagnetic surveys
73	D.F. and J.P. Patrie	Denyes, Halcrow--airborne and ground magnetic and very low frequency electromagnetic surveys
74	Pelangio Larder Mines/Bayridge Development	Horwood--induced polarization, diamond drilling
75	John Penttinen	Casselman--very low frequency electromagnetic survey
76	Pioneer Metals Corporation	Mallard--airborne magnetic and very low frequency electromagnetic surveys

TABLE 12.1. CONTINUED.

Number on Figure	Individual or Company	Activity
77	Placer Dome Incorporated	Lucas, Jamieson, Thorneloe, Loveland, Newmarket--magnetic, horizontal loop electromagnetic and very low frequency electromagnetic surveys McCart, Cote, Carscallen--magnetic, horizontal loop electromagnetic and very low frequency electromagnetic surveys, diamond drilling
78	G.J. Prior	Whitesides--geochemical survey
79	D.R. Pyke & Associates	Calder, Ottaway--geological survey
80	Quote Resources Inc.	Sothman--diamond drilling
81	B. Raine	Wark--very low frequency electromagnetic survey Murphy--magnetic survey
82	Raney Minerals Ltd.	Calvert--geological survey
83	Rio Algom Limited	Carnegie, Prosser--linecutting, magnetic and electromagnetic surveys
84	A.J. Salo	Clergue--geological survey
85	Seaview Resources	Walls--geological and geophysical surveys, trenching, sampling
86	J.P. Sheridan	Whitney--magnetic, horizontal loop electromagnetic and geological surveys Jessop--horizontal loop electromagnetic survey Deloro--manual work and electromagnetic survey
87	Silver Butte Resources	Chester--geological survey
88	R.G. Smith	German--geological survey Carscallen--overburden drilling
89	Stan North Mining Corporation	Ogden--diamond drilling
90	H. Sutherland	Whitney--magnetic survey
91	Tarzan Gold Incorporated	Clergue--magnetic and very low frequency electromagnetic surveys Horwood--geological survey, sampling
92	Tarzan Gold/Noranda Exploration	Keith--geological and geophysical surveys, sampling
93	T.B.S. Resources	Zavitz--geological, magnetic, very low frequency electromagnetic, horizontal loop electromagnetic and induced polarization surveys, stripping, assaying
94	Teck Corporation	Cunningham--geological and geophysical surveys, stripping, sampling
95	Timmins Nickel Incorporated	Whitesides--magnetic and very low frequency electromagnetic surveys
96	Timmins Nickel/Gold Bar Resources Inc.	Groves--linecutting, magnetic and induced polarization surveys
97	Total Energold Corporation	Tisdale--diamond drilling Shaw--horizontal loop electromagnetic and induced polarization surveys
98	Trader Resource Corporation	Macklem--diamond drilling
99	M. Tremblay	Greenlaw--magnetic, geochemical and airborne magnetic and very low frequency electromagnetic surveys Deloro--sampling
100	E. van Hees	Stock--magnetic and very low frequency electromagnetic surveys
101	Ventex Energy Ltd.	Blackstock, Thomas, Sheraton, Langmuir--diamond drilling
102	Westmin Resources Limited	Lower Detour Lake, Hopper Lake Areas--magnetic, electromagnetic, horizontal loop electromagnetic surveys, diamond drilling and assaying
103	F. Zoebelein	Carscallen--magnetic survey

A deep diamond-drilling program which resulted in the extension of the ore reserves from the 5000-foot level to the 5600-foot horizon was continued into 1989.

The orebody at Kidd Creek is diminishing in width with increasing depth. Consequently, as mining deepens, the annual production rate is expected to decrease by about 180000 t per year. Ore reserves are equivalent to about 17 years of production at planned operating rates.

Total projected lateral development at the No. 1 Mine and No. 2 Mine was 6100 m. Vertical development at the No. 1 and No. 3 mines totalled 4200 m.

At the Kidd Creek Mine, during 1989, 33426 m of diamond drilling was done. Of that total, 12578 m were drilled to delineate the orebody within the mine. Primary ore definition drilling totalled 6400 m. An additional 14448 m of exploration diamond drilling was done both

TABLE 12.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	4,724	12,347	24,715	172,600	318,347	46,227	522,490
1988	5,867	6,117	34,553	119,758	325,685	17,260	532,820
1987	8,934	4,402	34,474	120,384	612,631	32,001	807,277
1986	17,889	8,689	33,181	129,932	481,547	26,266	717,522
1985	6,052	10,024	23,207	131,330	278,881	34,032	503,338
1984	7,633	11,040	27,179	140,864	495,323	51,723	738,038
1983	11,859	4,967	30,586	128,126	199,892	44,755	407,161
1982	5,420	6,457	23,694	91,203	359,970	36,178	596,097
1981	8,934	2,934	24,731	114,823	261,301	23,177	471,827
1980	10,742	1,778	18,753	59,993	212,208	5,246	296,852
1979	3,975	2,504	9,597	40,850	59,605	5,480	151,003
1978	3,623	4,429	8,126	38,056	47,333	1,880	94,045
1977	2,438	4,336	8,932	77,496	135,134	3,755	228,090
1976	5,837	3,621	10,830	25,819	43,920	2,140	97,258
1975	4,162	4,142	8,614	83,388	108,420	1,300	200,034
1974	3,456	3,692	7,594	69,341	52,128	3,146	142,136
1973	2,258	3,728	6,460	58,495	50,022	2,500	114,917
1972	2,980	3,509	7,939	55,900	89,560	(1,400)	149,387
1971	3,840	3,708	(8,500)	52,401	131,385	1,050	195,457
1970	3,903	3,916	(8,600)	96,946	59,013	5,560	167,465
1969	3,482	3,687	(8,700)	86,397	53,497	1,188	143,303
1968	3,935	4,906	(9,000)	42,575	26,656	2,852	74,580
1967	2,944	8,356	(9,800)	79,634	32,220	871	117,299
1966	5,724	10,352	(15,250)	151,747	65,577	(5,000)	227,732
1965	47,900	9,922	(19,000)	242,869	224,959	(6,500)	486,246
1964	20,823	931	(25,000)	48,095	93,863	(1,000)	146,633
1963	1,971	1,326	(5,250)	34,328	2,348	(200)	40,370
1962	1,440	1,425	(4,500)	(19,000)	(10,000)	(3,200)	(35,000)
1961	1,443	1,578	(4,500)	(20,000)	(8,000)	(500)	(30,000)
1960	1,321	2,296	(4,750)	(21,000)	(9,000)	(1,400)	(39,000)
1959	2,247	1,803	(5,600)	(20,000)	(5,000)	(300)	(30,000)
1958	1,451	2,147	(5,280)	(17,000)	(4,000)	(3,000)	(30,000)
1957	2,456	2,440	(5,800)	(18,000)	(2,000)	(400)	(25,000)
1956	1,536	958	(5,800)	(25,000)	(10,000)	(4,500)	(45,000)
1955	1,793	757	(5,250)	(4,000)	(3,000)	(1,500)	(10,000)

Brackets indicate approximate figures.

underground and from surface in the immediate vicinity of the mine.

Approximately 2500 people were employed at the Kidd Creek operations (Falconbridge Limited, personal communication, 1989; Falconbridge Limited, Annual Report, 1988).

Timmins Nickel Inc.–BHP–Utah Mines Ltd.

Timmins Nickel Inc. acquired a 51 percent interest in the Redstone nickel deposit in Eldorado Township from BHP–Utah Mines Ltd.

A decline was started in January 1989, to evaluate the deposit from underground. An 11000-foot surface diamond-drilling program to extend and further define the deposit was also done in early 1989. One hole from this program obtained the best intersection ever on the property—19.6 feet grading 2.76 percent Ni at a vertical depth of 2400 feet.

An agreement was made with Giant Yellowknife Mines Limited to use the GOMILL at Schumacher to concentrate the nickel ore. The concentrate is shipped by rail to the refinery owned by Sherritt Gordon Limited in Fort Saskatchewan, Alberta. The first shipment was made in May 1989, and by the end of July, 1 million pounds of nickel had been produced.

The decline had almost reached the 500-foot level by the end of December 1989. The decline may be driven down to the 800-foot level. Major mine development which included the ramp, vent raise and sumps totalled 5900 feet.

Six levels have been established on the 100-, 150-, 200-, 270-, 340- and 410-foot elevations. Total level development was 6400 feet. Subdrifting totalled 1400 feet and raising totalled 1200 feet. A total of 3000 feet of underground drilling was also done.

By the end of October, a total of 43590 tons of nickel ore had been milled at an average head grade of 2.3 percent, producing 1.7 million pounds of nickel. By the end of 1989, it was estimated that an additional 18000 tons of ore would be milled.

Production is obtained by various methods of open stoping. The dip of the ore is very irregular (20° to almost vertical) and the width is narrow—from six inches to six feet. Some of the stopes are being filled with waste rock after mining has been completed. Eight stopes had been mined by the end of December 1989, and seven were in operation. The lowest mining level was 410 feet below surface.

Ore reserves to 1000 feet below surface have been calculated at 330000 tons at 2.89 percent Ni.

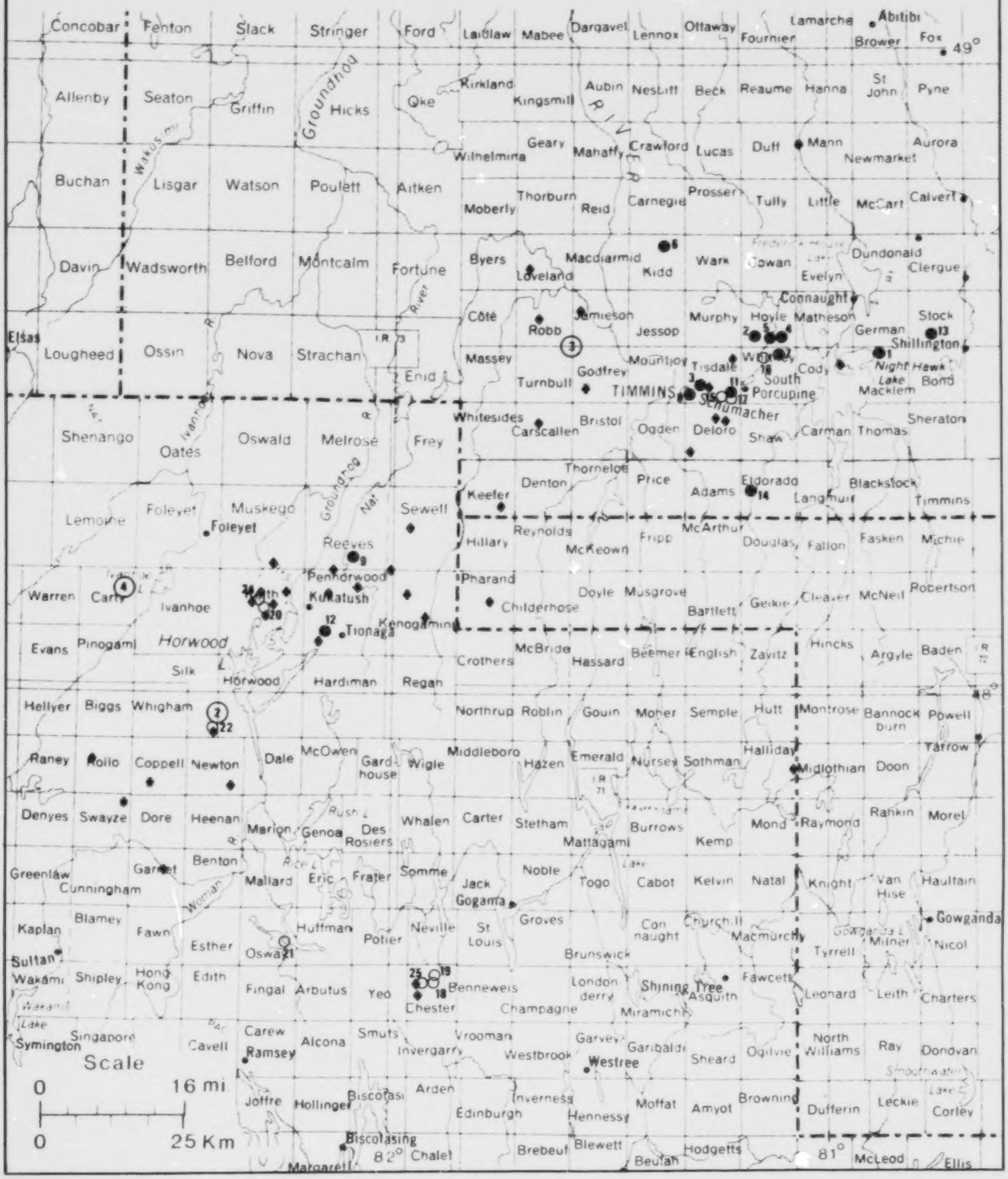
A power line into the property has been constructed from the Langmuir road. A bailey bridge has been installed at the Langmuir road crossing on the Redstone River through Northern Ontario Resources Transportation Committee (NORTC) funding.

Timmins Nickel Inc. acquired the Langmuir property, Hart and Tontine properties in adjacent Langmuir Township in the fall of 1989.

In September, a 35000-foot diamond-drilling program had been started to follow up on the previously mentioned diamond-drill intersection obtained earlier in the year on the Redstone deposit. A few encouraging intersections were obtained. In November, a surface diamond-drilling program was started 800 feet to the south of the Langmuir Mine (No. 2 zone) to delineate a

Figure 12.2

Timmins Resident Geologist's District


Concobar
Fenton
Slack
Stringer
Ford
Laidlaw
Mabee
Dargavel
Lennox
Ottaway
Fournier
Lamarche
Abitibi
Brower
Fox
49°
Allenby
Seaton
Griffin
Groundhog
Hicks
Oke
Kirkland
Kingsmill
Aubin
Nesbitt
Beck
Reaume
Hanna
St John
Pyne
Wilhelmina
Geary
Mahaffy
Crawford
Lucas
Duff
Mann
Newmarket
Aurora
Buchan
Lisgar
Watson
Poulett
Aitken
Moberly
Thorburn
Reid
Carnegie
Prosser
Tully
Little
McCart
Calvert
Davin
Wadsworth
Belford
Montcalm
Fortune
River
Byers
Loveland
Macdiarmid
Kidd
Wark
Cowan
Evelyn
Dundonald
Clergue
Connaught
Côté
Robb
Jamieson
Jessop
Murphy
Hoyle
Matheson
German
Stock
Shillington
Elsas
Lougheed
Ossin
Nova
Strachan
I.R. 73
Enid
Massey
Turnbull
Godfrey
Mountjoy
Tisdale
Whitney
Cody
Night Hawk Lake
Macklem
Bond
TIMMINS
South Porcupine
Schumacher
Whitesides
Carscallen
Bristol
Ogden
Deloro
Shaw
Carman
Thomas
Sheraton
Shenango
Oates
Oswald
Melrose
Frey
Thorneloe
Denton
Keefer
Price
Adams
Eldorado
Langmuir
Blackstock
Timmins
Lemoine
Foleyet
Muskego
Sewell
Hillary
Reynolds
McKeown
Fripp
McArthur
Douglas
Fallon
Fasken
Michie
Reeves
Penhorwood
Pharand
Warren
Carty
Ivanhoe
Kukatush
Childerhose
Doyle
Musgrove
Bartlett
Geikie
Cleaver
McNeil
Robertson
Tionaga
Kenogaming
Evans
Pinogami
Horwood
Silk
Horwood L.
McBride
Crothers
Hassard
Beemer
English
Zavitz
Hincks
Argyle
Baden
Hardiman
Regan
Hellyer
Biggs
Whigham
Northrup
Roblin
Gouin
Moher
Semple
Hutt
Montrose
Bannockburn
Powell
48°
Raney
Rollo
Coppell
Newton
Dale
McOwen
Gardhouse
Wigle
Middleboro
Hazen
Emerald
Nursey
Sothman
Halliday
Midlothian
Doon
Yarrow
Denyes
Swayze
Dore
Heenan
Marion
Genoa
Des Rosiers
Whalen
Carter
Stetham
Mattagami
Burrows
Kemp
Mond
Raymond
Rankin
Morel
Greenlaw
Cunningham
Garnet
Benton
Mallard
Eric
Frater
Somme
Jack
Gogama
Noble
Togo
Cabot
Kelvin
Natal
Knight
Van Hise
Haultain
Kaplan
Blamey
Fawn
Esther
Huffman
Potier
Neville
St Louis
Groves
Connaught
Churchill
Macmurchy
Tyrrell
Milner
Gowganda
Nicol
Sultan
Wakami
Shipley
Hong Kong
Edith
Oswald
Fingal
Arbutus
Yeo
Chester
Benneweis
Brunswick
Londonderry
Shining Tree
Asquith
Fawcett
Leonard
Leith
Charters
Champagne
Miramichi
Symington
Singapore
Cavell
Carew
Ramsey
Alcona
Smuts
Invergarry
Vrooman
Westbrook
Garvey
Westree
Garibaldi
Sheard
Ogilvie
North Williams
Ray
Donovan
Joffre
Hollinger
Biscotasi
Arden
Edinburgh
Inverness
Hennessy
Moffat
Amyot
Browning
Dufferin
Leckie
Corley
Biscotasing
82°
Chalet
Margaret
Brebeuf
Blewett
Beulah
Hodgetts
81°
McLeod
Ellis
Scale
0
16 mi
0
25 Km

5● Producing Mines 1989

1. Asarco Exploration Company of Canada Ltd., Aquarius Mine .... Au
2. Canamax Resources Inc., Bell Creek Mine ... Au
3. ERG Resources Inc. .... Au
4. Falconbridge Gold Corporation, Hoyle Pond Mine .... Au
5. Falconbridge Gold Corporation, Owl Creek Mine .... Au
6. Falconbridge Limited, Kidd Creek Mine ..... Cu, Zn, Ag, Pb, Cd, Sn, In
7. Giant Yellowknife Mines Limited,
   - Number 1 Mine .... Au
   - Number 3 and Number 5 Pits .... Au
   - Heap Leaching .... Au
8. Giant Yellowknife Mines Limited, Timmins Surface .... Au
9. Luzenac Incorporated .... talc
10. Placer Dome Inc., Detour Lake Mine .... Au
11. Placer Dome Inc., Dome Mine .... Au
12. Roseval Silica Incorporated .... Si
13. St. Andrew Goldfields Ltd. .... Au
14. Timmins Nickel Inc.-BHP-Utah Mines Ltd. ..... Ni

5○ Advanced Exploration and Development Projects 1989

15. American Reserve Mining Corporation - Placer Dome Inc. .... Au
16. Belmoral Mines Ltd. - Broulan Resources Inc. Au
17. Belmoral Mines Ltd. - Vedron Limited .... Au
18. Chesbar Resources Inc. - Murgold Resources Inc. .... Au
19. Gold Bar Resources Inc. - Canadian Gold Bar Resources Inc. .... Au
20. Marshall Minerals Corp. - Gail Resources Incorporated .... Au
21. Muscocho Explorations Limited - Jerome Gold Mines Corporation - E.B. Eddy Forest Products Limited - McNellan Resources, Inc. - Chesbar Resources Inc. .... Au
22. Orofino Reosurces Limited .... Au
23. Sherritt Gordon Limited - Newphos Ltd. .... phosphate
24. Tarzan Gold Inc. - Noranda Exploration Company, Limited .... Au
25. Young-Shannon Gold Mines Ltd. .... Au

⑤ Location of OGS Field Parties in 1989

2. The Geological Setting of Gold Mineralization in the Horwood Lake Area of the Swayze Belt, G.M. Siragusa
3. Geology of the Kamiskotia Area, Abitibi Subprovince, C.T. Barrie
4. Site Survey for Continental Drilling in the Kapuskasing Structural Zone, J.T. Bursnall and D. Moser

◆ Property Visits, 1989

TABLE 12.3. GOLD PRODUCTION FROM THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1988).

MINE NAME	TOWNSHIP	YEARS OF PRODUCTION	TONS MILLED	OZ. PRODUCED	GRADE
Ankerite	Deloro	1926-1953,-78	4,993,929	957,292	0.19
Ankerite/March	Deloro	1926-1935	317,769	61,039	0.19
Aquarius	Macklem	1984,1988	100,000	10,880	0.225
Aunor (Pamour No. 3)	Deloro	1940-1984	8,482,174	2,502,214	0.30
Banner	Whitney	1927-28,-33,-35	315	670	2.13
Bell Creek	Hoyle	1987-	166,549	34,206	0.235
Bonetal	Whitney	1941-1951	352,254	51,510	0.15
Bonwhit	Whitney	1951-54	200,555	67,940	0.34
Broulan	Whitney	1939-53	1,146,059	243,757	0.21
Cincinnati	Deloro	1922-1924	3,200	736	0.23
Concordia	Deloro	1935	230	16	0.07
Coniaurum/Carium	Tisdale	1913-18, 1928-1961	4,464,006	1,109,574	0.25
Crown	Tisdale	1913-1921	226,180	138,330	0.61
Davidson	Tisdale	1918-1920	9,341	2,438	0.26
		1988	43,850	7,301	
Delnite	Deloro	1937-1964	3,847,364	920,404	0.20
(open pit)	Deloro	1987-1988	59,067	3,602	0.77
DeSantis	Ogden	1933,1939-42, 1961-1964	196,928	35,842	0.18
DeSantis	Turnbull	1926		13	
Detour Lake Mine	Sunday Lake	1983-	4,259,000	410,209	0.10
Dome	Tisdale	1910-	45,306,914	11,563,961	0.27
Faymar	Deloro	1940-1942	119,181	21,851	0.18
Fuller	Tisdale	1940-1944	44,028	6,566	0.15
Gillies Lake	Tisdale	1929-31,35-37	54,502	15,278	0.28
Goldhawk	Cody	1947	636	53	0.08
Goldhawk (open pit)	Cody	1980	40,000	3967	0.10
Halcrow-Swayze	Halcrow	1935	211	40	0.19
Hallnor (Pamour No. 2)	Whitney	1938-68,-81	4,226,419	1,645,892	0.39
Hollinger--Schumacher	Tisdale	1915-1918	112,124	27,182	0.24
Hollinger (Pamour Timmins)	Tisdale	1910-1968,	65,778,234	19,327,691	0.29
		1976-1988	2,615,866	182,058	0.07
Hoyle	Whitney	1941-44,46-49	725,494	71,843	0.10
Hoyle Pond	Hoyle	1985-	375,598	202,850	0.61
Hugh-Pam	Whitney	1926,1948-65	636,751	119,604	0.19
Jerome	Osway	1941-43,1956	335,060	56,893	0.17
Joburke	Keith	1973-75,79-81	440,117	43,571	0.10
Kingbridge/Gomak	Chester	1935-36	1,387	98	0.07
McIntyre (Pamour Schumacher)	Tisdale	1912-1988	37,634,691	10,751,941	0.29
McLaren	Deloro	1933-37	876	201	0.23
Moneta	Tisdale	1938-1943	314,829	149,250	0.47
Naybob	Ogden	1932-1964	304,100	50,731	0.17
Owl Creek	Hoyle	1981-	1,548,112	186,360	0.12
Pamour No. 1 (incl.pits 3 & 4)	Whitney	1936-	33,147,661	3,307,581	0.11
(heap leach)		1988-	401,322	4,811	
Paymaster	Tisdale	1915-1966	5,607,402	1,192,206	0.21
Porcupine Lake/Hunter	Whitney	1937-40,1944	10,821	1,369	0.13
Porcupine Peninsular	Cody	1924-27,-40,-47	99,688	27,354	0.27
Preston	Tisdale	1938-1968	6,284,405	1,539,355	0.24
Preston N Y	Tisdale	1933	2,800	153	0.05
Preston/Porcupine Pet	Deloro	1914-1915		314	
Preston/Porphyry Hill	Deloro	1913-1915	46	312	6.78
Reef Mine	Whitney	1915-1965	2,144,507	498,932	0.23
Tionaga/Smith-Thorne	Horwood	1938-1939	6,653	2,299	0.35
Tisdale Ankerite	Tisdale	1952	14,655	2,236	0.15
Tommy Burns/Arcadia	Shaw	1917	21	14	0.28-0.34
Vipond	Tisdale	1911-1941	1,565,218	414,367	0.26
TOTAL			238,769,099	57,977,157	

N.B.
ERG Resources Inc. produced 18,260 oz. Au
from treatment of 2,549,189 tons of tailings
March/88-June/89

zone previously discovered. Drilling will also be done on the Langmuir No. 1 zone at which the previous operators had completed some underground development.

Line cutting and induced polarization (IP) surveys were started at the end of 1989 on the recently purchased properties.

TABLE 12.4. BASE METAL PRODUCTION FROM THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1988).

Mine	Township	Dates	Ore Milled (Tonnes)	%Cu	%Zn	%Ni	Ag (G/Tonne)	Au
Alexo	Dundonald	1912-19 1943-44	51 529	0.07		3.93		
Canadian Jamieson	Godfrey	1966-71	434 409	2.39	4.05			
Jameland	Jamieson	1969-72	461 805	0.99	0.88		3.5	0.05
Kam Kotia	Robb	1943-44 1961-72	6 007 194	1.09	1.03		3.5	0.05
Kidd Creek Mine	**Kidd**	**1965-**	**81 000 000**	**1.99**	**7.54**		**144.0**	
Langmuir	Langmuir	1973-77	997 903			1.5		
McIntyre	Tisdale	1963-81	10 162-640	0.62			0.09	0.023
United Obalski	Godfrey	1965-66	Data Unavailable					

At the end of 1989, there were 60 people employed by Timmins Nickel Inc. at the mine in Eldorado Township (Timmins Nickel Inc., personal communication, 1989; personal observation, 1989).

PRECIOUS METALS

Asarco Exploration Company of Canada Ltd., Aquarius Mine

The Aquarius Mine went into production in January 1988 and was in operation until August 1989, when milling was suspended. The mine is currently on standby status awaiting the results of an open pit feasibility study.

During 1989, horizontal development totalled 166 m and vertical development totalled 331 m. Underground diamond drilling totalled 2712 m. Most of the mining was in developed areas north of the shaft while in the area south of the shaft, mining activity was limited to the Syenite stope. Mine production from January to August 1989, totalled 39634 tons (short) at an average grade of 0.228 ounce Au per ton.

Although grades have been consistently high, it was proven difficult to maintain a 300 ton per day operation and at the same time continue to develop the mine with the current size shaft (Asarco Exploration Company of Canada Ltd., Lake Asbestos of Quebec Ltd., personal communication, 1989).

Canamax Resources Inc., Bell Creek Mine

Although the 1989 figures were unavailable at the time of writing, estimated production from the Bell Creek Mine will total 28230 ounces from 165000 tons grading 0.182 ounce Au per ton at a recovery of 94 percent. This includes ore from both the North "A" zone, which is accessed by the shaft at the Bell Creek Mine, and ore from the Marlhill zone which was brought into production in 1989. This compares to 24648 ounces produced in 1988 from 135324 tons grading 0.195 ounce Au per ton at a recovery of 93.4 percent. Most of the 1988 production came from the North "A" zone with a minor amount coming from development ore from the Marlhill zone.

During 1989, lateral development totalled 2430 m and underground diamond drilling totalled 3000 m.

At Bell Creek, vertical sublevel retreat mining has been phased out on the eastern side. Production now relies on shrinkage mining methods. A ramp will be driven from the bottom level, 240 m below surface, to access a level at 300 m. From here, additional ore will be mined and a base will be established for deep underground drilling. Underground drilling in early 1989 outlined ore to the 400 m elevation.

At Marlhill, the ramp was extended from the 100 m level to the 150 m level in 1989. There are currently five levels, one established every 25 m, but none as yet at the 150 m elevation. At the end of 1989, five shrinkage stopes were being mined.

The mine currently employs 140 people. In 1988, 92 people were employed (Canamax Resources Inc., personal communication, 1989).

ERG Resources Inc.

The Timmins gold tailings recovery facility owned and operated by ERG Resources Inc. is the second largest in the world. The company owns or controls 126 million tonnes of tailings in Timmins. Operations for the 1989 season began in March, a month earlier than the planned April start-up. The plant is still operating at the time of writing with a planned shut-down date of December 18, 1989. The successful operation of hydraulic mining and treating the material through the mill and leach circuit in below freezing temperatures is a step forward in the company's ability to strive for year-round operations rather than the eight-month operating season as originally planned. Gold production to the end of June 1989, totalled 18260 ounces, of which 14111 ounces were poured, from the treatment of 2810000 t of tailings at an average grade of 0.553 g/t Au. The project has yet to reach the target 60 percent recovery rate as defined by the pilot testing. Having demonstrated that the tonnage through-put of 40000 t per day can be maintained, emphasis is now being placed on reducing operating costs.

The project currently employs 40 people (ERG Resources Inc., Annual Report, 1989; ERG Resources Inc., personal communication, 1989; The Daily Press, various articles, 1989).

Falconbridge Gold Corporation

Falconbridge Gold Corporation, previously a wholly owned subsidiary of Falconbridge Limited, became a publicly held corporation on January 31, 1989. The new company owns the Hoyle Pond and Owl Creek gold mines in Hoyle Township, as well as almost the entire gold exploration property position in the Timmins area previously held by Falconbridge Limited.

HOYLE POND MINE

Hoyle Pond is an underground multiple narrow, quartz-carbonate vein mine which has been in production since 1985. In 1988, 97200 t of ore were milled at the Kidd Creek custom gold mill to produce 51300 ounces of gold. Estimated production for 1989 is 106000 t grading 18.5 g/t Au consisting of 85000 t of stope ore and 21000 t of development ore.

Underground exploration diamond drilling at the mine totalled approximately 26500 m. Of that total, 18800 m was contracted diamond drilling. No surface drilling was done in 1989.

Lateral underground development of 1375 m and raise development of 225 m was done. The current bottom level of the mine is the No. 5 level west at a depth of 220 m. There are presently 13 active stopes at the mine with 2 in the initial development stage. Reserves will be recalculated at year-end and are estimated at approximately 290000 t grading 16.5 g/t Au (Falconbridge Gold Corporation, personal communication, 1989; Falconbridge Gold Corporation, Annual Report, 1988).

OWL CREEK MINE

Owl Creek is an open pit mine which has been in production since 1981. In 1988, 189300 t of ore were produced of which 100000 t were processed with the remainder stockpiled. Owl Creek ores were processed either through the Kidd Creek gold mill, or at other custom milling facilities in the Timmins area, or fed directly to the Kidd Creek smelter as flux. Output of gold from Owl Creek in 1988 was 16400 ounces.

In June 1989, open pit mining was completed using a contractor for benches No. 7 and No. 8. It is estimated that 62000 t of Owl Creek ore will have been milled in 1989 (as a mix with ore from Hoyle Pond). As well, 87000 t of Owl Creek material was used as flux in the Kidd smelter. Year-end stockpiles should approximate 200000 t in all categories.

An underground exploration development program initiated in 1988 was completed by contractors in March 1989. Approximately 18000 m of underground exploration diamond drilling was done by contractors at Owl Creek in 1989.

Reserves in the open pit floor and underground will be determined in early 1990 following completion of the ongoing exploration program (Falconbridge Gold Corporation, personal communication, 1989; Falconbridge Gold Corporation, Annual Report, 1988).

Giant Yellowknife Mines Limited, Timmins Operations

In 1988, the Timmins Division of Giant Yellowknife Mines Limited produced gold from the six following operations: the Schumacher Mine (McIntyre), the No. 1 Mine, the Timmins property (Hollinger), the Delnite property (small open pit), the No. 3 pit and the Ross Mine. At the end of 1989, only the No. 1 Mine and the No. 3 pit were in operation. As well, a small pit, the No. 5 pit, was brought into production. In 1989, the Ross Mine was sold and subsequently closed at the end of the year.

NO. 1 MINE

The 1989 production at the No. 1 Mine in Whitney Township is expected to be 637000 tons of ore grading 0.080 ounce Au per ton. In 1988, the mine produced 41173 ounces of Au from 686684 tons at a grade of 0.069 ounce Au per ton. A total of 11000 feet of lateral development and 5400 feet of vertical development was done in 1989. This compares to the 1988 totals of 15000 feet and 9000 feet, respectively.

Underground diamond drilling in 1989 totalled 24400 feet compared to 29000 feet in 1988. Twenty percent of the ore came from narrow higher grade veins in volcanic rocks to the north. The remainder came from the lower grade extensive quartz stockworks in greywackes and conglomerates to the south. Surface diamond drilling on the mine property totalling 12500 feet was done to explore the volcanic rocks to the north adjacent to the Hoyle Mine property boundary and also to evaluate the No. 5 pit area to the west.

The adjacent Hoyle Mine property to the east was obtained from Falconbridge Limited and development began in June. A ramp is being driven underground from the No. 2 pit, previously mined by Pamour Inc. A haulageway is being driven on the 1400-foot level from the Pamour No. 1 Mine to intersect the Hoyle Mine workings. Mining will be done above the 700-foot level from the ramp from surface. The ore will be dumped into a planned ore pass and trammed to Pamour No. 1 Mine on the 1400-foot level. Reserves for the Hoyle property above the 700-foot level are 1.3 million tons grading 0.08 ounce Au per ton.

At the end of 1987, ore reserves for the Pamour No. 1 Mine were 49 million tons at 0.070 ounce Au per ton.

NO. 3 AND NO. 5 PITS

Production from the No. 3 and No. 5 pits on the Pamour No. 1 Mine property totalled 429 000 tons grading 0.067 ounce Au per ton. The No. 5 pit, which began operation in early summer, is scheduled to be mined out at the end of 1989. Production from open pits on the Pamour No. 1

property was 645261 tons at 0.056 ounce Au per ton in 1988.

TIMMINS SURFACE

Open pit mining began in 1976 on the former Hollinger Mine property and ended in June 1989. For the year, a total of 50821 tons grading 0.08 ounce Au per ton was produced.

HEAP LEACHING

After two years of heap leaching, a total of 9000 ounces of gold were recovered from 435000 tons of open pit material grading 0.024 ounce Au per ton. This material, from the No. 3 pit, would previously have been considered to be waste. A heap, totalling 120000 tons, will be leached in 1990.

At the end of 1989, the Timmins operations of Giant Yellowknife Mines Limited employed 450 people (Giant Yellowknife Mines Limited, personal communication, 1989).

Placer Dome Inc.

DETOUR LAKE MINE

Placer Dome Inc. is the sole owner of the Detour Lake Mine. Proven and probable diluted ore reserves as of January 1989, were 7800000 t grading 4.8 g/t Au. Ore reserves are currently being revised and will be published in 1990. Although the complete 1989 figures were unavailable at the time of writing, it is estimated that 125000 ounces of gold will have been recovered from 800000 t of ore milled. This figure includes 755000 t of underground ore grading 5.3 g/t Au and an additional 45000 t of stockpiled ore grading 1.4 g/t Au that was previously mined from the open pit. Production currently comes from three levels: the fifth (260 m), seventh (360 m) and ninth (460 m).

Lateral development totalled 3128.2 m until the end of November 1989. The ramp has been completed from the 200 m level to the 460 m level and from the 120 m level to the surface. The section of the ramp from the 120 m level to the 200 m level is scheduled to be completed by May 1990.

In 1989, underground diamond drilling totalled 17000 m. This figure includes ore definition drilling as well as exploration drilling on the 120 m and 560 m levels. Surface drilling for 1989 amounted to 1500 m in six holes. The surface drilling is being carried out 600 to 1000 m west of the headframe and is the first exploration drilling carried out on the mine property since 1976.

At the end of 1989, 400 people were employed at the Detour Lake Mine. This figure includes 43 contract workers (Placer Dome Inc., personal communication, 1989).

DOME MINE

The new No. 8 shaft was in full production in April of 1989 after being shut down since May 1988, when extensive damage was caused by a skip falling down the shaft. Underground production was maintained at a reduced rate through the No. 3 shaft. An increase in production from two open pits on the mine property compensated for the shortfall of ore not obtained from the No. 8 shaft.

Although the 1989 production figures were unavailable at the time of writing, it is estimated that 146400 ounces of gold will be recovered from 1343000 tons of ore milled. Underground production will be 1 million tons grading 0.125 ounce Au per ton and open pit production will be 279500 tons grading 0.08 ounce Au per ton. The remaining ore was from previously mined stockpiled open pit ore.

In 1988, 109890 ounces of gold were recovered from 1.1 million tons at an average grade of 0.101 ounce Au per ton and with a 95.9 percent recovery.

Mill capacity has increased from 3300 tons per day in 1988 to 3800 tons per day in 1989.

Ore sources by mining methods in 1989 were 21 percent from longhole stopes, 26 percent from large mechanized cut-and-fill stopes, 8 percent from stopes using "in-the-hole" drilling, 7 percent from narrow vein cut-and-fill stopes, 8 percent from the overdrawing of slough muck from longhole and old shrinkage stopes and 8 percent from development. The remaining 22 percent came from the open pit.

Ore reserves at the end of 1988 were calculated to be 6.4 million tons grading 0.151 ounce Au per ton. The 1989 figures were not available at the time of writing.

In 1989, 15400 feet of lateral development (drifts, crosscuts and subdrifts) and 2700 feet of raising were done. These figures were higher than the 1988 totals of 14300 and 1450 feet, respectively.

In 1989, underground diamond drilling totalled 61000 feet. This is slightly lower than the 1988 figure of 62000 feet. Surface diamond drilling for 1989 amounted to 11106 feet. This drilling was done to outline ore in the open pit areas.

The deepest stope was 4000 feet below surface. The top mining level was 900 feet below surface. Most underground mining was done above 4000 feet below surface (26th level).

The mine employed 703 people in 1989, as compared to 712 in 1988 (Placer Dome Inc., personal communication, 1989).

St. Andrew Goldfields Ltd.

The St. Andrew Goldfields Ltd. mine in Stock Township was officially brought into production on October 1, 1989.

During the six-year period since the project entered the advanced development phase, the company has established a reserve base of 1300000 tons of ore averaging 0.186 ounce Au per ton in three zones, built a 500 ton per day mill and completed substantial underground development. The remaining interests of Esso Resources Canada Limited have been bought out and the mine and surrounding properties are now wholly owned by St. Andrew Goldfields Ltd.

During 1989, the company completed an extensive surface exploration program. In Stock Township, 14 holes were diamond drilled into the East zone for a total footage of 15991 feet. In Taylor Township, four holes totalling 2938 feet were drilled from surface into the Shoot zone and seven holes totalling 12232 feet were drilled in the West Porphyry zone. Results of surface drilling confirm the potential for finding additional ore reserves. Surface drilling to the west of the main zones at the mine gave reported assays of 0.16 ounce Au per ton over 8.6 feet and 0.11 ounce Au per ton over 15 feet.

Underground, 18000 feet of diamond drilling was done during 1989. Five levels have been developed with levels 1 through 4 being accessed from the 885-foot shaft and the fifth level being accessed by ramp. During 1989, 8300 feet of ramping and 9000 feet of lateral development was done. Due to bad ground at the bottom of the shaft, the 6th and 7th levels will be accessed by the continuation of the ramp.

Mining methods include four cut-and-fill stopes, a room-and-pillar stope, and two longhole stopes on the M-2 zone plus an open stope in the M-1 zone. Classified mill tailings and waste rock from underground development are being used as fill.

By the end of 1989, 100000 tons of ore will have been milled to produce 10000 ounces of gold. Estimated production for 1990 is 27000 ounces of gold from 175000 tons of ore milled.

The mill at St. Andrew Goldfields uses a cyanidation and carbon-in-pulp process which has a capacity of 500 tons per day. A recovery rate of 94 percent is expected. A cyanide destruction circuit has been included to ensure that clean backfill is produced.

The mine employs 95 people (St. Andrew Goldfields Ltd., personal communication, 1989; The Daily Press, July 3, 1989; The Northern Miner, May 15, 1989).

INDUSTRIAL MINERALS

Luzenac Incorporated

Steetley Talc Incorporated began production at its Penhorwood Township open pit in 1978, producing 300 tons per year. Production rates increased yearly, and by 1988, when Luzenac Incorporated purchased the Steetley operations, annual production had reached 50000 tons per year.

The ore is mined and the talc concentrated at the mine site in Penhorwood Township. The concentrate is then trucked to the fine-grind plant in Timmins. Figures for 1989 production and operations were not available at the time of writing. For further information, please refer to Table 12.3.

Roseval Silica Incorporated

During the second half of 1989, Roseval Silica Incorporated resumed silica quarrying operations at the Penhorwood Township site. Before production began, a combined stripping, trenching and surface diamond-drilling program was completed to evaluate three new potential quarry sites on the property. Most of the preliminary work was carried out at the No. 3 quarry site which went into production in late August 1989. A total of 569 m in eight holes were diamond drilled; three holes to test the No. 3 quarry site at depth and five holes to test the south extension of the No. 2 quarry site.

Production from the No. 2 quarry between September 29 and October 20, 1989, totalled 10658 t of quartz. Waste rock totalling 9881 t was removed. Total quartz produced from the No. 3 quarry during the period August 23 to October 30, 1989, was 54917 t with 21777 t of waste removed. All quarrying, crushing and loading operations were carried out by L. Alarie and Sons Limited, of Timmins. The crushing facility was upgraded to a 300 ton per hour, unitized mobile plant which eliminated the severe downtime problems encountered in 1988 using a 100 ton per day mobile crusher. A total of 20924 t of quartz was crushed in 1989.

During 1989, Roseval Silica Incorporated shipped approximately 55750 tons of quartz material with a minimum 92 percent silica content to Falconbridge Limited's metallurgical site in Hoyle Township. Most of the material shipped was unsized pit-run material. Falconbridge was initially interested in the undersized fraction (less than 1 inch) produced as a by-product of the crushing operations on the high-purity material, but it was determined that the moisture content of the material stockpiled on site was too high for metallurgical purposes. The moisture content would have to be reduced to about 1.5 percent from approximately 4 percent. Roseval is considering building dry storage facilities for the -1 inch material.

By mid-November, Roseval had shipped 5718 t of quartz material with an average 99 percent silica content to SKW Alloys Incorporated in Becancour, Quebec. An additional 581.58 t of similar grade material was shipped to SKW Alloys Incorporated in Niagara Falls, New York. An additional 1000 t of high-purity quartz is scheduled to be shipped to SKW Alloys Incorporated by the end of November when operations will cease for the winter.

Currently stockpiled on-site are 4500 t of -3/8 inch material, 4770 t of 3/8 to 1 inch material, 7877 t of 1 to 5 inch material destined for SKW Alloys Incorporated and 680 t of uncrushed, pit-run material.

Roseval Silica Incorporated and L. Alarie and Sons Limited employed between 8 and 11 people at the quarry site during production in 1989 (Roseval Silica In-

TABLE 12.5. INDUSTRIAL MINERAL PRODUCTION FROM THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT 1989.

Mine	Township	Date	Production	
			(1989)	(to Date)
Penhorwood Mine (Talcs de Luzenac SA)	Penhorwood	1978-	43,158	282,881
			(tons talc produced)	
Roseval Silica Inc.	Penhorwood	1988-	46,735	116,235
			(tons silica produced)	

corporated, personal communication, 1989; personal observation, 1989).

ADVANCED EXPLORATION AND DEVELOPMENT

American Reserve Mining Corporation–Placer Dome Inc.

At the end of 1988, American Reserve Mining Corporation merged with Associated Porcupine Mines Ltd., taking over a 100 percent interest in that company. This takeover included total ownership of the old Paymaster Mine in Tisdale Township. In April 1989, it was announced that American Reserve had purchased an additional 200 acres of land adjoining the Paymaster property to the east from Diepdaume Mines Ltd. In mid-1989, American Reserve and Placer Dome Inc. finalized an agreement by which Placer Dome paid American Reserve $18.2 million for a 60 percent interest in the Paymaster property. The deal included a $5.25 million work commitment by Placer Dome.

A program to access potential ore beneath 5500 feet below surface was initiated. By the end of 1989, the No. 5 shaft had been dewatered to the 3750-foot level and the shaft had been rehabilitated to 3600 feet below surface. The No. 5 shaft goes to the 4375-foot level and the No. 6 winze goes from 3900 feet to 6025 feet below surface. A hoist will be installed at the winze and the winze will be dewatered and rehabilitated to the bottom. Underground diamond drilling totalling 10000 feet is planned. If a production decision is reached, the winze may be extended to 7000 feet. Ore will be hoisted to the top of the No. 6 winze and trammed to the No. 8 shaft of the Dome Mine by extending the Dome underground workings to connect to the Paymaster workings or alternatively, may be hoisted up the Paymaster No. 5 shaft and trucked to the Dome mill.

In addition to the above work, an extensive surface exploration program was done by Placer Dome. Line cutting, geological mapping and 1 1/4 miles of backhoe trenching were completed along with channel sampling to explore for possible open pit ore. A surface diamond-drilling program is proposed for 1990 (Placer Dome Inc., personal communication, 1989; The Northern Miner, April 17, 1989, and July 3, 1989).

Belmoral Mines Ltd.–Broulan Resources Inc.

Work on the property was discontinued in April of 1989. During those first four months, rehabilitation of the Broulan Reef shaft was completed; the shaft had been deepened the final 9 feet to the 2590-foot depth and rehabilitation of the 2500-foot level was started. This rehabilitation is now complete for the first 1370 feet. Another 333 feet of by-pass drift, around an old stope, was also driven. A drift on the 500-foot level was advanced 134 feet to access the "C" zone.

Underground diamond drilling totalled 7627 feet in 1989. It was done to outline the "C" zone and to test for a possible extension of "C" zone-type mineralization at depth.

Surface diamond drilling totalled 15823 feet. Most of this footage was drilled approximately 1500 feet west of the Reef shaft to explore for open pit ore in an area of gently dipping veins. Three holes were also drilled 2500 feet north of the shaft to test a geophysically indicated shear subparallel to the Reef fault. No significant mineralization was encountered north of the shaft, but to the west, a near-surface potential reserve of 336000 tons was outlined. The drill-indicated grade is 0.043 ounce Au per ton. Previous diamond drilling in this type of mineralization in the old mine gave similar grades, while the underground mining showed that the actual grade was over three times higher. If the same factor is applied to the recently outlined tonnage, a grade of 0.138 ounce Au per ton may be possible. A program of stripping to obtain a bulk sample for a mill test was planned before the shut down.

A deep western extension of the Reef zone was tested with two longholes but no significant mineralization was encountered.

Many targets still remain unexplored. The most significant are listed below:

1. a zone near the Hallnor boundary with a potential of containing the repetition of No. 11, No. 19 and No. 21 Hallnor veins, which averaged 0.36 ounce Au per ton
2. "C"-zone repetition between 500- and 2500-foot levels
3. the western extension of the open pit zone along strike
4. the Reef fault area below 2500-foot level
5. a zone west of the Reef shaft and below 2500-foot level

Since the start of the project in October 1986, the following work had been performed on the property by Belmoral Mines:

Surface diamond drilling:	40 400 feet
Underground diamond drilling:	18 727 feet
Drifting and crosscutting:	2 434 feet
Raising:	9 feet
Shaft deepening:	62 feet
Shaft station advancement:	6 feet
Miscellaneous advancement:	384 feet
Total underground advancement:	2 895 feet
Drifts and crosscuts rehabilitation:	4 990 feet

Total expenditures by Belmoral as of November 1989, were $15123047.

Belmoral Mines Ltd.–Vedron Limited, Joint Venture

Underground development and diamond drilling was discontinued on the property in January 1989. During this month, a total of 199 feet of drifting was completed in the hanging wall zones on the 375- and 500-foot levels. Underground diamond drilling amounted to 2344 feet, mainly in the carbonatized zones on the 275- and

500-foot levels. There was no surface diamond drilling in 1989.

An independent ore reserve calculation, contracted by Vedron Limited and conducted by Mining Corp. of Canada Ltd., was completed in May 1989. It gives an undiluted total of proven, probable and possible reserves above the 650-foot level of 360880 tons, averaging 0.17 ounce Au per ton.

It is believed that considerable potential still remains untested in the main zone: at the contact zone between the massive and the pillowed basalts; in the hanging wall of this zone; in the folds of highly carbonatized rocks; and in the mineralized parts of a feldspar porphyry intrusive in the core of the synclinal structure.

The downward extension of the gold-bearing structure has been confirmed to the 2500-foot depth.

The following work has been performed by Belmoral Mines Ltd. since the start of the project in mid-1986:

Surface diamond drilling:	33 614 feet
Underground diamond drilling:	70 159 feet
Decline to 650-foot depth:	4 611 feet
Drifting and crosscutting:	6 263 feet
Raising:	995 feet
Miscellaneous advance:	2 820 feet
Total underground advance:	14 689 feet

Total Expenditures by Belmoral as of November 1989, were $15713537 (Belmoral Mines Ltd., personal communication, 1989).

Chesbar Resources Incorporated-Murgold Resources Incorporated

Early in 1989, all surface and underground exploration and development operations ceased on the joint venture partners' Chester Township gold deposit. Weak gold prices and difficulty in raising additional funding were cited as contributing to the shutdown decision. Proposed construction of an on-site 150 ton per day gravity and flotation mill was also deferred.

A total of 9931.8 t of gold-bearing development material was shipped to the GOMILL facility in Timmins for processing. Recoveries from higher grade material averaging 4.8 g/t Au were 65 percent via a gravity jig concentrate and 27 percent via a flotation concentrate for a total gold recovery of 92 percent. A total of 792 ounces of gold was recovered from the entire bulk sample, giving a final recovered grade of 2.5 g/t Au.

Based upon the surface and underground work completed to date on the No. 3 vein zone, current reserves above the 150 m level are estimated at 460273 t averaging 8.1 g/t Au. The zone remains open at depth.

Surface exploration on the 70-claim group continued through the 1989 field season. Ground geophysical surveys were completed and detailed geological mapping was undertaken over the entire property. Several targets for follow-up evaluation were reported at the conclusion of the field season. An exploratory diamond-drilling program was scheduled to begin before year-end to test the southwest continuation of the recently discovered No. 3 zone on the Gold Bar Resources Inc.-Canadian Gold Resources Inc. property, located immediately north of the Chesbar-Murgold property. The new zone trends onto the Chesbar-Murgold claims close to where Chesbar-Murgold's northwest trending No. 1 vein zone is projected to be. Drilling will test for the presence of both zones, particularly where they are projected to intersect (Chesbar Resources Incorporated, Murgold Resources Incorporated, personal communication, 1989; Murgold Resources Incorporated, press releases, 1988-89; Chesbar Resources Incorporated, Annual Report, 1988; The Northern Miner, October 2, 1989, p.2; personal observations, 1989).

Gold Bar Resources Inc.-Canadian Gold Resources Inc.

Gold Bar Resources Inc. is earning an interest in the 11 leased claim Kidd property located in north-central Chester Township.

Earlier work on the property revealed the presence of two gold-bearing structures. The No. 1 zone, located in the central part of the property, is an east-trending structure that had been traced for approximately 400 m along strike and drill-tested to a vertical depth of 130 m. The No. 2 zone, located in the northeast corner of the property, has been traced for 460 m west from the property's east boundary. The west-trending No. 2 zone is exposed at surface for 122 m at the east property boundary. A 6457 t bulk sample was taken from the No. 2 zone in 1987 in an attempt to verify drill-indicated grade estimates and to determine the metallurgical characteristics of the mineralized material. Results of this bulk sample are unavailable.

Early in 1989, a three-phase surface diamond-drilling program was started to further evaluate the No. 1 zone. Midway through the second phase of drilling, a new mineralized structure, trending 035°, was intersected while attempting to follow the No. 1 zone west across a diabase dike. Follow-up drilling confirmed the strike and continuity of the new zone, designated No. 3, and much of the third phase of drilling was directed at defining this zone. Phase I drilling totalled 1508 m in 6 holes, all completed on the No. 1 zone. Phase II drilling consisted of 12 holes drilled on the No. 1 zone and 4 holes completed on the No. 3 zone totalling 2719.1 m. Phase III program, still in progress in November, included 34 holes totalling 5154.2 m on the No. 1 zone, and 63 holes totalling 8234 m to date on the No. 3 zone. At the time of writing, approximately 600 m in 3 holes remained to be drilled on the No. 3 zone. Exploratory drilling to test various IP targets outlined earlier in 1989 included 8 holes totalling 1315.8 m.

The No. 1 zone is interpreted to be a continuous, variably sheared, east-trending structure dipping 70° south. The structure crosses intrusive contacts between granodioritic, trondhjemitic and quartz dioritic phases of a high level, multiphase intrusive. Coarse free gold is associated with chalcopyrite, pyrrhotite and pyrite in lenses and pods of quartz and quartz-carbonate within the structure.

Gold mineralization is widespread but erratic due to the discontinuous nature of the quartz veins, compounded by the coarse, free nature of the gold. The quartz lenses appear to have a limited strike-length, but recent drilling indicates a downplunge continuity. Drilling at 30 and 50 m spacings on the No. 1 zone has traced it along trend for 520 m and to a vertical depth of 180 m. The average width of the structure is 3 m.

The recently discovered No. 3 zone is a 035°- to 045°-trending structure that extends southwest from the west end of the No. 1 zone and dips 55° to 65° southeast. It has been traced by drilling at 30 and 50 m spacings for 370 m along trend and to a vertical depth of 250 m. Current drilling will test the northeast part of the known zone at a vertical depth of 320 m. The mineralized structure is open along trend and at depth.

The No. 3 structure differs from most of the known gold-bearing structures in the Chester camp. Mineralization is controlled by a 3 to 5 m wide linear shear occurring at the contact between a hanging wall diorite and fine-grained granodiorites on the footwall. Numerous narrow (2 to 5 cm) quartz veins carrying coarse free gold occur within a chlorite-biotite schist sparsely mineralized with pyrite, pyrrhotite, chalcopyrite and minor native antimony. Sulphide content rarely exceeds 3 percent except at the west end of the tested portion of the structure, where wider, sulphide-rich quartz veins have been reported. The average width of mineralization within the structure is 2.2 m. Quartz veining is more continuous and assay results are less erratic than the No. 1 zone. Some drill-core samples with free gold have returned subeconomic values. With more than half of the holes completed on the No. 3 zone still out for assay at the time of writing, Gold Bar Resources Inc. indicated that visible gold had been observed in 37 of 67 holes drilled to date.

Upon completion of the current diamond-drilling program, a prefeasibility study will be undertaken to determine if an underground exploration program can be carried out. Gold Bar Resources Inc. is considering a decline ramp access to test the grade and continuity of the No. 1 and No. 3 zones at depth. Current drilling will test the complicated nature of the junction between the two vein systems which is not exposed on surface (Gold Bar Resources Inc., personal communication, 1989; The Northern Miner, various articles, 1989; personal observations, 1989).

Marshall Minerals Corp.-Gall Resources Incorporated

Evaluation of the recently discovered "Patricia" and "135" shear zones on the Sangold Project property in Keith Township continued through 1989. The 1989 program consisted of geological mapping, extensive stripping on surface showings and geophysical targets, and surface diamond drilling which totalled 6957 m in 49 holes.

On the "Patricia" zone, surface drilling totalled 6219 m in 41 holes. Results indicate gold mineralization is contained in sheared, northwest-trending mafic to ultramafic tuffs and flows cut by north-trending, quartz carbonate veins mineralized with 5 to 50 percent pyrite and minor chalcopyrite. The mineralized rocks are underlain by massive to pillowed mafic metavolcanics and successively overlain by felsic lapilli tuffs, a thin band of graphitic sediments and a thick sequence of rhyolitic flows. Quartz-carbonate veins occur as an *en échelon* series of "Z"-folded lenses characterized by extensive thickening, limited strike-length, and the development of boudins and dislocated rods of mineralization at the tails of the "Z" folds.

Detailed drilling on the Patricia vein indicates a strike-length of approximately 100 m with widths between 1 and 15 m. It has been traced to a vertical open depth of 195 m. Published drill-indicated reserves to 150 m vertical are 90718 t at an average grade of 6.2 g/t Au.

Deep drilling on the Patricia zone intersected two new mineralized vein structures that are, as yet, undefined. The No. 1 West vein occurs approximately 30 m stratigraphically below and trends parallel to the Patricia vein. The south end of the No. 1 West vein overlaps the north end of the Patricia vein. It is open at depth and to the north. The Deep Vein zone occurs approximately 30 m stratigraphically above the Patricia vein. It does not appear to extend above the 120 m level. Only three drill holes have tested the Deep Vein zone and it is open along strike and at depth.

Marshall Minerals Corp. is currently examining the feasibility of open pitting the upper portion of the Patricia vein which is partially exposed on surface. They are encouraged by the recent discovery of additional mineralized veins within the Patricia shear zone and additional diamond drilling is planned for 1990.

The "135" zone is a west-trending shear approximately 30 m wide occurring within rhyolitic flows overlying the Patricia zone. The structure is confined to an interflow sequence of felsic tuffs and graphitic, argillaceous sediments near the top of the felsic pile. The structure was first discovered in 1986, but initial stripping and sampling programs returned only anomalous gold values in sparsely mineralized quartz-carbonate veins.

In 1989, additional stripping eastward from the original showing revealed the presence of a series of branching veins variably mineralized with pyrite, chalcopyrite, sphalerite and galena. Grab samples and channel samples across the well-mineralized portions of the veins returned values in excess of 20 g/t Au. Eight surface diamond-drill holes totalling 737.6 m were subsequently completed to test the zone at depth. Five distinct, narrow, mineralized shears were intersected within the main structure. Additional work is scheduled in 1990 to evaluate the "135" zone which is open along strike and at depth (The Northern Miner, January 9, 1989, p.17; Marshall Minerals Corp., personal communication, 1989; personal observations, 1989).

Muscocho Explorations Limited–Jerome Gold Mines Corporation–E.B. Eddy Forest Products Limited–McNellan Resources, Inc.–Chesbar Resources Inc.

The combined surface and underground exploration program initiated in 1987 on the Jerome Mine property in Osway Township continued until April 1989. At that time, the surface plant was put on care and maintenance and the underground workings were allowed to flood.

Underground development on the 152 m level was completed by February 1989. The East drift was slashed out for 305 m from the shaft to accommodate trackless equipment. From that point, a crosscut was driven south for 107 m to access the South zone. Drifting on the South zone totalled 146 m, of which 133 m was in mineralization. On both the east and west ends, mineralization was truncated by faults. Chip sampling of drift faces on the west drift averaged 9.6 g/t Au across 1.8 m for the 72 m long exposure. Muck samples for the same 72 m length averaged 4.1 g/t Au across the development drift width of 2.5 m.

An underground diamond-drilling program totalling 4000 m in 24 holes was completed in 1989. Drilling on the South zone from setups on the Main zone drift totalled 1121 m in seven holes. Two holes totalling 64 m were drilled from the Main zone to test the North Main zone which was first intersected during the surface drilling program. A total of 2511 m in 12 holes was completed from setups on the South zone drift to test the downdip and downplunge extension of the Main zone. Three exploratory holes totalling 305 m were also drilled from various setups on the 152 m level. In addition, 40 short holes totalling 885 m were completed with a Bazooka drill to test for mineralization in the drift walls on the Main and South zones from the 152.4 m level.

A three-phase surface diamond-drilling program carried out between December 1987, and March 1989, totalled 23889 m in 93 holes. Total metres drilled included the deepening of 17 holes.

The surface drilling program on the South zone consisted of 64 holes. The Main zone and the east and west extensions of the Main zone structure have been traced by diamond drilling for 2750 m along trend in 29 holes.

A recently revised reserve estimate is 523894 t at an average grade of 6.85 g/t Au. This figure represents "accessible" mineral inventory in the probable and possible categories above the 244 m level.

Upon completion of the advanced exploration project at the Jerome mine site, ground geophysical surveys and geological mapping was carried out on the joint venture partners' claims adjoining the mine property (Muscocho Explorations Limited, personal communication, 1989; Jerome Gold Mines Corporation, personal communication, various press releases, 1989; The Northern Miner, January 16, 1989, p.3; personal observations, 1989).

Orofino Resources Limited

Based upon the results of the $3.8 million surface and underground exploration program completed in 1988, Orofino Resources Limited reported accessible proven and probable reserves of 123830 t with an average grade of 7.0 g/t Au above the 104 m level. An additional 453592 t of possible mineable reserves grading 6.2 g/t Au exists from the 104 m level to 290 m below surface. The possible mineable reserves are part of a larger, geologically inferred mineral inventory estimated to contain 1179339 t grading 3.8 g/t Au from the 104 m level to a vertical depth of 370 m.

No further work was carried out on the property in 1989, but Orofino is considering several production alternatives (Orofino Resources Limited, personal communication, 1989; George Cross News Letter, January 11, 1989, p.1; personal observations, 1989).

Sherritt Gordon Limited–Newphos Ltd.

During the spring of 1989, there was a restructuring of the companies involved in the Cargill–Martison Lake phosphate properties. Campbell Resources Inc. sold its 50 percent interest in the properties to Newphos Ltd.

Newphos Ltd., a wholly owned subsidiary of Central Capital Corporation, agreed to buy the properties for $1 million and a 4 percent revenue royalty. The royalty will reduce to 2 percent after $5 million has been received. Under the agreement, Newphos Ltd. must complete a production feasibility study of the property within 24 months or return the joint venture interest to Campbell Resources Inc. Campbell Resources Inc. had acquired its initial interest in the Martison property in 1982 from Shell Canada Resources Ltd. and two years later, entered into a joint venture with Sherritt Gordon Mines. Sherritt contributed the neighbouring Cargill property in return for a 50 percent interest.

During the summer of 1989, Newphos Ltd. retained the services of Kilborn Engineering to manage the extraction, processing and shipment of a phosphate bulk sample to the Sherritt Gordon Research Centre in Fort Saskatchewan, Alberta.

The work, which began in early July, included the dewatering of the existing pit and removal of 8000 t of overburden. A 4000 t sample of phosphate was then extracted from the pit and hauled to a test mill on site. The mill, which processed 7 t of phosphate rock per hour, was used to remove clays found within the residual apatite. The deslimed phosphate was then transported to Hearst by truck. By the end of November 1989, 4000 t of phosphate rock will have been trucked to Hearst, where the sample will be dried and then shipped by rail to the Sherritt Gordon processing plant in Alberta.

If and when commercial mining begins, all material will have to be shipped to Alberta because the companies involved have decided against the construction of a processing plant on site. This would entail the construction of a trunk line to the mine site and negotiation of a price with Canadian National to have the material shipped out (The Northern Miner, June 1989; personal observations, 1989; Kilborn Engineering, personal communication, 1989).

Tarzan Gold Inc.–Noranda Exploration Company, Limited

Evaluation of the Joburke property, a former producing gold mine located in north-central Keith Township, began late in 1988 and continued through 1989. During the latter part of 1988, the joint venture partners completed an initial 18-hole, 4048 m, surface diamond-drilling program designed to extend areas of known mineralization along trend and to depth.

During 1989, an additional 24 surface holes totalling 6154 m were drilled on the property. Main targets were the North, Main and 6-7 vein zones, with the majority of holes drilled to test the North and 6-7 vein zones. The Joburke structure has now been drill tested for 1050 m along trend and to a vertical depth of approximately 250 to 300 m.

The stripped and trenched areas exposed prior to freeze-up in 1988 were cleaned, mapped and sampled in detail during the 1989 field season. The stripping program was carried out to evaluate the along-trend mineral potential of the Joburke structure and to test geophysical targets on the property.

Results to date indicate the North and 6-7 vein zones are high-grade shoots of variable width with limited strike lengths of about 100 m within a major northwest-trending deformation zone that has been traced for 1500 m across the property.

The Main and Main East zones, from which most of the past production was taken, are also high-grade shoots having limited strike-length which occupy a parallel-trending shear structure approximately 130 m to the south. The 6-7 vein zone appears to plunge steeply east, while the North zone has a shallow westerly plunge of about 40°, suggesting the two zones may come together at depth. Both zones are open downplunge. Host rock for the mineralized shoots are sheared to mylonitized mafic metavolcanics and quartz-sericite-chlorite-carbonate schists.

Additional targets associated with the high-strain deformation zones remain to be tested. East of the known mineralized shoots, an IP anomaly has been identified adjacent to the original, 1946 discovery trench. Additional IP targets located west along trend will also require testing.

Reserve inventories have not been calculated from the work done to date. The North zone has been drill tested on 50 to 60 m centres and the 6-7 vein zone has been tested on 30 to 40 m centres. Additional fill-in drilling to firm up potential reserves is planned for 1990 (Tarzan Gold Inc., press releases, 1989; The Northern Miner, various articles, 1989; Tarzan Gold Inc., Noranda Exploration Company, Limited, personal communication, 1989; personal observations, 1989).

Young–Shannon Gold Mines Limited

Late in 1989, Young–Shannon Gold Mines Limited acquired 100 percent interest from Northquest Ventures Inc. in the Three Duck Lakes property, an 11 patented claim gold property, located in central Chester Township.

An extensive surface diamond-drilling program started late in 1988 continued during 1989, and is scheduled to be completed in the spring of 1990. From December 1, 1988, to mid-November 1989, 119 holes totalling 15 590 m had been completed on the property. Drilling in the fall continued at a reduced pace due to soft ground conditions. Much of the planned winter drilling will be from the ice on Three Duck Lakes.

Most of the diamond drilling completed to date was directed at the "C" zone structure which hosts the Young–Shannon gold deposit. Since re-evaluation of the "C" zone began in 1987, 127 holes totalling 16 215.6 m have been completed with 109 holes totalling 14 273.6 m drilled in 1988–89.

The zone has been drill tested at 30 to 50 m centres along trend for 853 m and to a maximum depth of 213 m. The 065°-trending structure is open along trend and at depth. A north-trending diabase dike cuts the eastward extension of the zone near the point where it continues under Three Duck Lakes and, for approximately 150 m east of the dike, the structure is poorly defined. Assay results for the eastmost hole included 13.0 g/t Au across 2.44 m at a vertical depth of approximately 40 m. Drilling from the ice 150 m west of the dike encountered multiple intersections exhibiting good grade across narrow widths in several holes along a 152.4 m strike length. Additional drilling is planned from the ice this winter to better define this section of the "C" zone structure.

The "B" zone is a 110°- to 115°-trending structure located approximately 530 m north of the "C" zone. Four holes totalling 305 m were completed on this structure to test the eastern extension of the surface showing known as "Ed's Trench". Drilling has defined the mineralized structure for 100 m along trend and to a vertical depth of 46 m. The "B" zone structure is faulted off to the west, but open to the southeast and at depth.

To date, five holes, totalling 752.25 m, have been completed on the "A" zone, located on the east shore of Three Duck Lakes, approximately 1200 m southeast and along trend of the "B" zone. A sixth hole was in progress at the time of writing. Recent step-out drilling to the north and northeast of the surface showing encountered several new mineralized zones exhibiting a variety of structural trends. Additional drilling is required to determine how extensive the new structures are.

A single exploration hole collared on the north shore of Three Duck Lakes was pushed southward for 260 m at -45°. The last 120 m contained disseminated chalcopyrite mineralization in a silicified granodiorite with the last 15 m in the hole averaging better than 0.2 percent copper. Some sections returned anomalous gold values up to 1.4 g/t across narrow widths. The silicified copper zone may represent a broad alteration halo and additional drilling may be directed at the zone.

Analysis of the drilling data is on-going and Young–Shannon Gold Mines Ltd. is contemplating an underground exploration program on the "C" zone in 1990. No reserve figures have been determined as yet (Young–Shannon Gold Mines Ltd., personal communication, 1988–89; The Northern Miner, various articles, 1989; personal observations, 1989).

ABITIBI BELT EXPLORATION ACTIVITY

R.E. Allerston

R.E. Allerston completed geophysical surveys on his property in Evelyn Township (R.E. Allerston, Prospector, personal communication, 1989).

American Barrick Resources Corporation–HSK Minerals Limited

American Barrick Resources Corporation completed an 11-hole, 2015 m, surface diamond-drilling program early in 1989 on the Muskasenda Lake property in English and Beemer townships under option from HSK Minerals Limited. Drill targets included airborne electromagnetic (AEM) anomalies and surface gold showings discovered in 1988. The original gold showing diamond drilled by HSK Minerals Limited in 1987 was not drill tested. American Barrick Resources Corporation subsequently dropped the option on the property (American Barrick Resources Corporation, HSK Minerals Limited, personal communication, 1989).

J. Arengi

J. Arengi completed geochemical surveys and diamond drilling on his property in Bartlett Township (J. Arengi, Prospector, personal communication, 1989).

Asarco Exploration Company of Canada Ltd.

During 1989, Asarco Exploration Company of Canada Ltd. drilled 19 diamond-drill holes (3575.1 m) on their property in Macklem Township. As a result of this program, a large tonnage, low-grade, gold zone was outlined in an altered siliceous rock which follows the contact between ultramafic and volcanic rocks. Further work is planned for 1990.

Favourable results were returned from one of three holes drilled near the old Aquarius shaft. To assist in the planning stages of a proposed open pit, the three vertical holes were drilled for hydrological information.

In addition to exploration work in Macklem Township, the company drilled one hole in German Township which intersected several ductile deformation zones in a conglomeratic unit north of the Porcupine Destor fault.

In Cleaver and Fallon townships, three holes with a total depth of 775 m were drilled. In Tisdale Township, the company completed surface sampling on claims acquired during the June 1st staking rush (Asarco Exploration Company of Canada Ltd., personal communication, 1989).

Aslan Exploration Development Limited

Although Aslan Exploration Development Limited did not do any work on their property in Robb and Jamieson townships during 1989, results from 1988 were encouraging. The company plans further work on the project depending on available financing (Aslan Exploration Development Limited, personal communication, 1989).

Aurogin Resources Ltd.

In December 1988, Aurogin Resources announced the signing of an agreement with Morrison Minerals Ltd. to drill 12 kimberlite pipe targets in the James Bay Lowland. Aurogin Resources Ltd. based its option acquisition on the results of a helicopter-borne low-level survey carried out by Morrison Minerals Ltd. During February and March 1989, Aurogin drilled eight holes on seven of the targets. Of the seven targets drilled, five were identified as pyroxenite pipes, one as a serpentinized peridotite and the other a magnetite-rich volcanic rock. Aurogin could have earned a 50 percent interest by drilling one hole on each target and 1000 feet of follow-up drilling for each pipe that was confirmed as kimberlitic. The option agreement has been extended and drilling of the other five targets is being considered (The Northern Miner, March 6, 1989; George Cross News Letter, March 21, 1989; Aurogin Resources Ltd., personal communicationn,1989).

BHP–Utah Mines Ltd.

BHP–Utah Mines Ltd. began several projects in the Timmins Resident Geologist's District in 1989. Geological mapping, pulse electromagnetic (EM) and magnetic surveys were done on the Relic Lake property in central Halliday Township and on the Ferrier Lake property in southwest English Township. Results from both programs are currently being evaluated. Plans for 1990 include a diamond-drilling project on the company's property in southeast Whitney Township (BHP–Utah Mines Ltd., personal communication, 1989).

Black Cliff Mines Ltd.

The company completed a geological mapping program and diamond drilling on their property in Ogden Township. Results from the drilling were not encouraging and no further work is planned (Black Cliff Mines Ltd., personal communication, 1989).

Canhorn Mining Corporation

The company completed geophysical surveys on claims held in Jessop Township. As follow up to targets defined by these surveys, diamond drilling is planned depending on the availability of financing (Canhorn Mining Corporation, personal communication, 1989).

Canamax Resources Inc.

During 1989, Canamax Resources Inc. completed eight diamond-drill holes totalling 2822 m on the Bell Creek property in Hoyle Township as part of an ongoing gold exploration program. An additional seven diamond-drill holes totalling 235.2 m were drilled on the Vogel option about 1.5 km east of the mine site. It has been reported that two new mineralized zones were intersected but no further details have been made available.

At the end of November 1989, another surface drilling program began to explore for satellite gold deposits within the Bell Creek Mine property (Canamax Resources Inc., personal communication, 1989; Timmins Daily Press, April 29, 1989).

Chevron Resources Canada Limited

Chevron Canada Resources Limited drilled a total of 1460 m on the Holmer Gold Mines Limited property in Bristol Township. In all, seven holes were drilled. It was reported that the company had outlined four new alteration zones on the property in addition to the main zone, which contains a mineral inventory of 400000 tons grading 0.15 ounce Au per ton.

The property is currently inactive in spite of the fact that drilling in 1989 intersected a new zone to the east of the main zone at a depth of 1100 feet. Chevron Canada Resources Limited, in the latter half of 1989, made the decision to curtail mineral exploration operations in Canada. The Timmins office was closed in October and the status of the company's remaining properties in Ontario is in question (The Northern Miner, January 9, 1989, April 1989, September 25, 1989; Chevron Canada Resources Limited, personal communication, 1989).

Cominco Ltd.

Cominco Ltd. completed surface geophysical surveys on leased claims in Byers Township. Other activities included claim staking. Additional work in the Porcupine Mining Division is planned for 1990 (Cominco Ltd., personal communication, November 1989).

Comstate Resources Ltd.

During 1989, Comstate Resources Ltd. completed line cutting, EM surveys and magnetic surveys on claims held in Reid, Thorburn and Jessop townships. Results have been positive and further work is planned for 1990 (D.R. Pyke & Associates, personal communication, 1989).

Cross Lake Minerals Ltd.–Teck Corporation

Cross Lake Minerals Ltd. and Teck Corporation completed a joint venture program on a 35-claim property in Wilhelmina Township. Following ground magnetic and EM surveys, Teck Corporation drilled two holes totalling 280.3 m. The diamond drilling was sited on EM anomalies and designed to test for nickel potential. Results of the drilling program have not yet been released (R.S. Middleton Exploration Services, personal communication, October 1989).

Diepdaume Mines Ltd.

As the adjacent Paymaster property was being pumped out, the water level at the old Preston East Dome Mine, owned by Diepdaume Mines Ltd., went down. The company rehabilitated the shaft from the 600-foot level to the 1200-foot level.

Work at the newly constructed mill included the fabrication of a load-out facility to enable ore trucks to dump directly into a crusher. No milling was done in 1989 (Diepdaume Mines Ltd., personal communication, 1989).

Ekersval Resources Ltd.

Geological mapping, prospecting and soil sampling were carried out on Ekersval Resources Ltd.'s Minnipuka property. The property consists of 89 contiguous mining claims located in west-central Minnipuka and east-central Walls townships.

The program was carried out in May and June 1989, in order to better define the bedrock lithologies, and prospect previously outlined geophysical anomalies for gold and base metal mineralization. No significant quartz veining, alteration or structure was detected during the survey. One sample of ironstone yielded an anomalous gold value of 265 ppb.

A follow-up diamond-drilling program was completed during October of 1989. A total of 11 holes were drilled in Walls and Minnipuka townships. An eight-hole, 943 m, program was completed in Minnipuka Township and a three-hole, 270 m, program in Walls Township (Ekersval Resources Ltd., personal communication, 1989; Assessment Files, Timmins Resident Geologist's office).

Falconbridge Limited

Falconbridge Limited continued to be the most active organization exploring in the Timmins area. The majority of effort was spent in exploring for volcanogenic massive sulphide (VMS) deposits. Exploratory drilling for VMS deposits was divided between the Kidd area where 70 percent of the total diamond drilling was done and the Kamiskotia area. Gold exploration programs were centred on the areas in proximity to the Hoyle Pond and Owl Creek mines.

The company also had an active nickel exploration program during 1989 with 3442 m of diamond drilling completed on various properties in the Timmins area.

1989 DRILLING SUMMARIES

Drilling supervised by Falconbridge Limited's Timmins Exploration office, to October 31, 1989, totalled 52339 m in 159 diamond-drill holes and 4302 m of drilling in 91 reverse circulation overburden drill holes. It is estimated that an additional 14000 m of diamond drilling will be completed by year end.

The drilling can be broken down as follows:

Drill Statistics to October 31, 1989

	Diamond Drilling		Reverse Circulation	
	Holes	Metres	Holes	Metres
Nickel	9	3 442	91	4 302
VMS (Cu, Zn)	144	47 225	0	0
Gold	6	1 672	0	0
Total	159	52 339	91	4 302

(Falconbridge Limited, personal communication, 1989).

Fiedmont Resources Ltd.

A five-hole, 3265-foot (995.17 m), drilling program was completed on Fiedmont Resources Ltd.'s Parnell township property during May 1989. The 231-claim property straddles the eastern half of the Ecclestone–Parnell township line. The holes were drilled to verify coincident magnetic and EM anomalies outlined by previous ground geophysical surveys. Three holes were drilled in the northwestern portion of the property and intersected sedimentary formations, including conglomerate, siltstone and sandstone. Massive sulphides were intersected in two of the holes but did not return any gold values. The remaining two holes were drilled 2.8 km to the east and intersected mafic volcanic rocks, diorite and quartz diorite with minor sulphides (Assessment Files, Timmins Resident Geologist's office).

Golden Crescent Resources Corp.–Placer Dome Inc.

A 4800-foot drilling program is expected to begin in December 1989, on the Border group of claims which Golden Crescent Resources Corp. optioned from Placer Dome Inc.

The property is situated on the Quebec–Ontario border about 12 km southeast of the Detour Lake gold mine. The Border group is found within the Detour Lake greenstone belt and is underlain by ultramafic to intermediate volcanic rocks in the north and greywacke in the south. The lower Detour Lake fault crosses the southern portion of the property and 1 km to the north, a gold mineralized zone runs parallel to the fault (The Northern Miner, November 6, 1989; Placer Dome Inc., personal communication, 1989).

Golden Dragon Resources Ltd.

Golden Dragon Resources Ltd. established a grid and completed magnetic and EM surveys over a 28-claim property in Bond Township. The work was done in early 1989 (R.S. Middleton Exploration Services, personnel communication, October 1989).

Golden Pheasant Resources Inc.

The company has completed diamond drilling on claims in Langmuir and Carman townships. Three gold-bearing iron formations were identified but no values of economic significance other than those reported in 1988 were announced (Vancouver Stockwatch, February 1989).

Granges Exploration Ltd.

In 1989, Granges Exploration Ltd. completed a detailed exploration program on their Eldorado–Bonanza Project in Eldorado Township. Geological mapping, power trenching, magnetic and horizontal loop electromagnetic (HLEM) surveys were done on the property which is "sandwiched" between the Redstone nickel deposit and the Langmuir Mine. A reinterpretation of data from the 1988 Ontario Geological Survey, Timmins Area Airborne Electromagnetic and Total Intensity Survey is also being done. Diamond drilling is planned for January 1990 (Granges Exploration Ltd., personal communication, 1989).

L. Hill

Encouraged by favourable results received from a platinum group element sampling program in 1988, L. Hill increased his holdings in northwest Mann Township to a total of 149 claims. In addition to claim staking in 1989, L. Hill concentrated on surface prospecting and sampling. Additional work including diamond drilling is planned for 1990 (L. Hill, Prospector, personal communication, 1989).

HSK Minerals Limited

A grass roots exploration program was conducted on the property of HSK Minerals Limited during September and November 1988. The property consists of 971 contiguous unpatented mineral claims in Caithness, Doherty and Pelletier townships and is shared equally by joint venture partners HSK Minerals Limited, X-Cal Resources Ltd., Noront Resources Ltd. and the Doelcam Mining Corporation.

An eight-person crew carried out the program over six different grids on the property. The grids were established in a variety of different geological environments and subjected to an intensive exploration program of soil sampling, geological mapping and prospecting. A total of 2998 soil samples and 186 rock samples were collected with several containing elevated values for base metals.

During the summer of 1989, a follow-up program of stripping and trenching was completed over three areas thought to have potential for hosting a polymetallic base metal deposit (Assessment Files, Timmins Resident Geologist's office).

Inco Exploration and Technical Services Inc.

In 1988, Inco optioned 35 claims in Bartlett and McArthur townships from Norwin Resources. During 1989, Inco did power stripping and channel sampling on these claims. Two small trenches were completed, one in the vicinity of the Hewett shaft and another on the Wesport Porcupine showing.

Additional work in the Porcupine Mining Division consisted of channel sampling and trenching in Zavitz Township north of Moray Lake on AEM anomalies from airborne geophysical surveys flown in the 1960s.

Large-scale reconnaissance geological mapping was done in the Shining Tree area, including traverses in

Semple and Sothman townships (Inco Exploration and Technical Services Inc., personal communication, 1989).

James Bay Kaolin Corporation

The James Bay Kaolin Corporation continued to explore for silica sand and kaolin on its property in Kipling Township during 1989.

Work included the staking of 79 claims in Emerson Township and an additional 69 claims in Kipling Township. A reconnaissance sonic drill program, which began in December of 1988, was completed over an area approximately 13 km long and 3 km wide in Kipling and Emerson townships. The drilling helped to identify potentially economic deposits of kaolin-silica sand.

The drill core was shipped to Parry Sound where the company has constructed a processing plant. The 138000 square foot facility is to be used for the establishment of a pilot plant and research facility designed specifically for the processing and evaluation of kaolin and silica sand.

Following freeze-up this fall, the company hopes to begin extraction of a bulk sample for shipment to its plant in Parry Sound (James Bay Kaolin Corporation, personal communication, 1989; Assessment Files, Timmins Resident Geologist's office; personal observations, 1989).

Kaphearst Resource Corporation

Kaphearst Resource Corporation continued to explore within its 1655-claim property in the Kapuskasing area during 1989. The company signed joint venture agreements with Steeler Resources and Colt Resources on two separate properties, consisting of 58 claims each, in Scholfield and Talbott townships.

The agreement called for Steeler and Colt to spend a minimum of $150000 each to earn a 50 percent working interest on their claims.

Steeler Resources optioned the property in Scholfield Township and completed a four-hole, 400 m, diamond-drilling program during February 1989. All four holes were drilled to test EM anomalies outlined by an earlier, ground geophysical survey.

Colt Resources optioned the property in Talbott Township and completed a five-hole, 400 m, diamond-drilling program during March 1989 (Assessment Files, Timmins Resident Geologist's office; George Cross News Letter, February 7, 1989; B. Durham Geological Services, personal communication, 1989).

Manridge Explorations Limited

On June 28 and 29, 1989, a combined airborne magnetic and very low frequence electromagnetic (VLF-EM) survey was carried out over the 109-claim property of Manridge Explorations Limited in east-central Walls Township. Results indicate that the property is underlain by units of metavolcanic rocks separated by granitic intrusive rocks, a circular ultramafic body, and two diabase dikes. Twelve bedrock conductors were identified (Assessment Files, Timmins Resident Geologist's office).

Markbridge Resources Ltd.

During February and March 1989, ground geophysical surveys were carried out over two separate grids on the company's 261-claim property in southeast Minnipuka Township. Grid "A", situated in the northwest quarter of the property, covered 40 claims, while grid "B", located 1 km to the southeast, covered 11 claims.

A magnetic and Max-Min HLEM survey was carried out over grid "A" and was successful in identifying several areas of probable base and precious metal mineralization. A magnetic and a Slingram EM survey was carried out over grid "B". Both grids were part of a geological mapping, prospecting and soil sampling program conducted in late May and early June 1989. A total of 64 grab and channel samples were taken from both grid areas. No significant alteration or gold mineralization was detected on either grid, although some ironstone units were found to be anomalous in copper and zinc.

A seven-hole, 940 m, diamond-drilling program was completed over selected areas of the property during August 1989. The drilling was carried out to test coincident magnetic and EM anomalies outlined by previous ground geophysical surveys (B. Durham Geological Services, personal communication, 1989; Assessment Files, Timmins Resident Geologist's office).

Marshall Minerals Corporation

The company completed nine exploration diamond-drill holes on the Malga property in southeast Shaw Township in 1989. Total footage drilled was 2806 feet. On the adjoining Carshaw property, 27 holes (8356 feet) were diamond drilled for exploration and "fill-in" purposes. To date, 210 holes have been drilled on the Carshaw prospect. The deposit has been tested to a vertical depth of 500 feet. The ore appears to be concentrated along the upper and and lower contact zones of an iron formation. Ore reserves are currently being recalculated (J. Hinzer, J. Lill, Prospectors, personal communication, 1989).

W. Miller

W. Miller continued to prospect for graphite on his 12-claim property in Foch Township. Preliminary test work carried out by the Industrial Minerals Section of the Geological Survey of Canada has been encouraging. The graphite may have the potential for producing high grade flakes (+95%) in the -300, +150 μm size fraction. Additional work will provide a basis for further processing studies (W. Miller, Prospector, personal communication, 1989; personal observations, 1989).

Moneta Porcupine Mines Inc.

In a joint venture with Freeport-McMoran Gold Company, Moneta Porcupine Mines Inc. drilled one 1000-foot diamond-drill hole on property held in Tisdale Township. Line cutting and surveying of 62 miles of grid lines are currently taking place on the property. Further work including additional diamond drilling and IP surveys are planned for 1990.

During 1989, the company staked claims in Bond, Loveland, Murphy and Tisdale townships and acquired mining leases in Loveland Township.

As part of an evaluation program, 363 samples were taken and depth testing was completed on sections of the Moneta Mine tailings. At this time, permits to remove tailings are in place.

The company has also purchased the Kayorum and the Mace properties in Deloro and Tisdale townships.

A compilation of previous work done on these properties is currently underway (Moneta Porcupine Mines Inc., personal communication, 1989).

Newmont Exploration of Canada Limited

During January 1989, Newmont Exploration of Canada Limited completed a magnetic survey over its 30-claim property located immediately east of West Hopper Lake. The survey helped to identify northeast-trending magnetic stratigraphy (Assessment Files, Timmins Resident Geologist's office).

New Texmont Explorations Ltd.

During 1989, New Texmont Explorations Ltd. completed construction of an eight-mile road to two gold zones in Tully Township, the Intex and Frankfield deposits. The company has completed a $2.2 million exploration program of this property, including 5000 feet of diamond drilling in 1989. Drill-indicated reserves for the Frankfield zone above 350 feet are 300000 tons grading 0.21 ounce Au per ton.

Results of diamond drilling to date indicate that gold values are in a tuff horizon following the contact between an ultramafic unit and an intermediate volcanic unit.

A deep hole drilled in 1989 intersected 75 feet grading 0.159 ounce Au per ton in the Main zone, at a vertical depth of 1700 feet.

An additional gold zone was reported with two intersections approximately 1500 feet vertically below surface. Values of 0.299 ounce Au per ton over 11.8 feet were returned.

Work on the property has been encouraging and future plans include additional diamond drilling and an exploration shaft to explore the deposit at greater depth (The Northern Miner, August 7, 1989; J.P. Sheridan, New Texmont Explorations Ltd., personal communication, 1989).

Noranda Exploration Company, Limited

During 1989, Noranda Exploration Company, Limited, had a diverse exploration program in the Timmins Resident Geologist's District. Efforts were concentrated on both gold and base metals. Previous to diamond drilling, various types of ground geophysical surveys were done on most of the properties.

In Macklem Township, 10 diamond-drill holes totalling 2700 m were completed on the Pominex gold property. Additional work is planned for 1990. Another 4000 m were drilled adjacent to the Pominex ground. A single hole was completed on the Cody property near Night Hawk Lake.

Emphasis in 1989 was placed on base metal exploration and geophysical surveys were done on properties to the north of Timmins in the Loveland area.

Gold values were recorded from an 18-hole (7000 m) diamond-drilling program on the Mountjoy Project. A 5000-foot diamond-drilling program in Stock Township, begun in 1988, was completed in 1989 (Assessment Files, Timmins Resident Geologist's office; Noranda Exploration Company, Limited, personal communication, November 1989).

Pamorex Minerals Inc.

In 1988, Pamorex Minerals Inc. acquired the exploration properties belonging to Giant Yellowknife Mines Limited and Pamour Inc.

NIGHT HAWK PROJECT

Dewatering of the underground workings of the Porcupine Peninsular Mine, a former gold producer in Cody Township, began in January 1989. Evaluation of the deposit included 17500 feet of underground diamond drilling and 35000 feet of surface drilling, of which 50 percent was done from a barge on Night Hawk Lake. The current phase of the project has been completed, and the results of a study to determine the feasibility of developing the deposit for commercial production are expected in 1990. Published reserves for the deposit before the 1989 program were 1.3 million tons grading 0.15 ounce Au per ton.

The remainder of the work done by Pamorex Minerals Inc. in 1989 was mine site exploration completed on behalf of Giant Yellowknife Mines Limited. These programs consisted primarily of underground diamond drilling designed to discover additional and higher grade reserves adjacent to existing mining operations.

On the Aunor–Delnite project in Deloro Township, 5500 feet of underground diamond drilling was done in 1989.

A major stripping program was done to expose the surface expression of veining intersected during a diamond-drilling program conducted this past winter. Quartz veining with pyrite mineralization surrounded by carbonate and sericite alteration was uncovered in an area south of Coniaurum Lake and west of the Bishop Shaft. Further investigations included diamond drilling and surface sampling.

The underground drilling segment of the Schumacher–Coniaurum project in Tisdale Township has been suspended due to flooding, with a total of 6000 feet drilled in 1989. The surface diamond-drilling program is ongoing with 75000 feet having been drilled to date (Pamorex Minerals Inc., Annual Report 1988; Pamorex Minerals Inc., personal communication, 1989).

Placer Dome Inc.

Placer Dome Inc. explored three properties in Carscallen, Cote and McCart townships during 1989. Work on these properties included line cutting, ground geophysical surveys and 795 m of surface diamond drilling. Results of the past year's programs are being evaluated (Placer Dome Inc., personal communication, 1989).

D.R. Pyke & Associates

D.R. Pyke & Associates completed geological mapping of their 69-claim group in Calder and Ottaway townships (D.R. Pyke & Associates, personal communication, 1989).

Quote Resources Inc.

The company completed 3000 feet of diamond drilling on their property in Sothman Township. Values from drill intersections of up to 0.26 ounce Au per ton over 15 feet have been reported. Although the best assay results came from a disseminated pyrite zone between a felsic agglomerate and a mafic flow, anomalous gold values were also present in quartz carbonate veins. The option on the property has been dropped (Vancouver Stockwatch, February 1989; Quote Resources Inc., personal communication, 1989).

Rio Algom Limited

Rio Algom Limited optioned ground in Carnegie and Prosser townships from Abitibi Price Inc. An additional 80 claims were staked adjoining the Abitibi Price ground. During 1989, line cutting, magnetic and EM ground surveys were completed on the property.

A diamond-drilling program and sonic overburden drilling are planned for early 1990 (Rio Algom Limited, personal communication, 1989).

Seaview Resources

Seaview Resources completed a ground geophysical and geological survey on their 11-claim property in Walls Township. Additional work included trenching and sampling (M. Tremblay, Prospector, personal communication, 1989).

Stan North Mining Corp.

The evaluation of the former DeSantis Mine in Ogden Township was placed on standby in 1988 following completion of Phase II of the project. At that time, the property was held in joint venture by Stan West Mining Corp., Canacord Resources Inc. and Noranda Exploration Company, Limited. Early in 1989, Stan North (controlled by Stan West Mining Corporation) acquired the interests of the other two partners. A 50 percent interest in the property was subsequently optioned to Golden Terrace Resources Corporation. Work on the property in 1989 consisted of 15000 feet of surface diamond drilling on the six-claim group in Ogden Township. Reported reserves are 700000 tons at 0.08 ounce Au per ton or 350000 tons at 0.19 ounce Au per ton.

At the time of writing, Stan North had decided to drop the option on the property (The Northern Miner, July 3, 1989; Stan North Mining Corp., personal communication, 1989).

Tarzan Gold Inc.

Tarzan Gold Inc. established a grid on their 10-claim property in Clergue Township. A ground magnetic survey was conducted in early 1989 (R.S. Middleton Exploration Services, personnel communication, October 1989).

Total Energold Corporation

During 1989, Total Energold Corporation completed a 3000-foot diamond-drilling program on the Davidson Mine's property in northeast Tisdale Township. The program was designed to test the downdip extension of the Main zone. In December 1987, published reserves were 53000 tons grading 0.23 ounce Au per ton. A similar surface drilling program is planned for 1990.

Total Energold also conducted Max-Min HLEM and IP surveys over their Goose Lake property claims in Shaw Township (Total Energold Corporation, personal communication, 1989).

Trader Resource Corp.

During 1989, Trader Resource Corp. completed an exploration program on the Ronnoco gold mine's property in Macklem Township. The best intersection from diamond drilling of a mineralized porphyry structure was a 116-foot section which assayed 0.107 ounce Au per ton over a true width of 66.5 feet. Drill-indicated reserves of 4.1 million tons grading 0.103 ounce Au per ton have been outlined. A bulk sample of the property has been proposed. Although results from the 1989 program were encouraging, the level of activity on the property during 1990 will depend on how successful the company is in arranging financing for the project (The Northern Miner, February 1989, September 1989; Trader Resource Corp., personal communication, 1989).

M.A. Tremblay

M.A. Tremblay completed a sampling program on his Big Dyke prospect claims in Deloro Township. Values of up to 0.20 ounce Au per ton have been reported and further work is planned for 1990 (M.A. Tremblay, Prospector, personal communication, 1989).

Ventex Energy Ltd.

A 4000-foot diamond-drilling program begun in December 1988, was completed by the company on their claims in Thomas and Sheraton townships in January 1989 (Assessment Files, Timmins Resident Geologist's office).

RECOMMENDATIONS FOR PROSPECTING IN THE TIMMINS AREA

One cannot ignore the fact that gold deposits in the Timmins area are at least spatially related, if not structurally related, to the Porcupine-Destor fault. Several recent discoveries in the Timmins area have been to the east and in close proximity to the fault. Although this area was thought to have good exploration potential, it was not actively explored during the earlier cycles of gold exploration activity due to extensive overburden cover. Sophisticated geophysical techniques and methods of geochemically sampling glacial till had not been developed until recently.

Gold mineralization has and can be found in splays off the main Porcupine fault structure as well as the Pipestone fault to the north. Shadow plots of the recent Ontario Geological Survey airborne magnetic surveys may show these splays.

The Porcupine-Destor fault in Cody, Macklem, German, Stock and Taylor townships occurs as a zone rather than one definite break. This zone consists mostly of talc-chlorite altered komatiitic rocks; however, extensive carbonate altered areas occur within it. These carbonate zones may have potential for containing economic gold mineralization (e.g., Asarco's Aquarius Mine in Macklem Township). As well, felsic bodies which can be gold-bearing also occur within the altered komatiites. Examples include the Trader Resources' Ronnoco gold deposit in northwest Macklem Township, the felsic zone at the Aquarius Mine, the Pominex gold zone in northeast Macklem Township, the N-2 zone at St. Andrew Goldfields Mine in Stock Township and Canamax Resources' Clavos gold zone within the Pipestone fault in the north part of German Township.

The carbonated komatiites and the felsic bodies may occur as magnetic lows as compared to the more magnetic talc-chloritic rock.

Extensive fault zones may be mapped using detailed VLF-EM surveys and possible gold-bearing felsic bodies may be outlined using detailed IP surveys since disseminated pyrite is usually a common accessory mineral.

Again, since most of the potential gold zones occur in areas of extensive overburden, conventional prospecting and geological mapping cannot be used. Detailed geophysics, overburden drilling and diamond drilling must be used to locate mineralized zones.

RECOMMENDATIONS FOR PROSPECTING IN THE JAMES BAY LOWLAND

A number of pronounced aeromagnetic anomalies which occur beneath the muskeg cover of the James Bay Lowlands have never been identified. These anomalies are thought to represent intrusions of ultramafic, mafic and/or alkalic origin and warrant additional prospecting for mineral commodities associated with their respective rock suites, such as, diamonds and niobium.

In the Moose River Crossing area, a large tonnage, high-grade gypsum deposit outcrops along the shores of the Moose River. In order to help determine the economic viability of the deposit, the Ministry of Northern Development and Mines has undertaken an assessment of high-purity gypsum markets in North America. The results of this study, if positive, should enhance future exploration efforts in the area.

SWAYZE BELT EXPLORATION ACTIVITY

American Barrick Resources Corporation-Glen Auden Resources Limited-Goldrock Resources Incorporated

In 1989, American Barrick Resources Corporation entered into an agreement with Glen Auden Resources Limited and Goldrock Resources Incorporated to earn up to 60 percent interest in two separate properties; a 219 unpatented claim group in central Penhorwood Township and a 426 unpatented claim group centred on the common corner of Penhorwood, Reeves, Sewell and Kenogaming townships (Four Corners Property).

As operator, American Barrick conducted detailed geological mapping and sampling programs on both claim groups during the past field season. Following compilation of geological and geophysical data compiled by Glen Auden and Goldrock prior to American Barrick's participation, an 11-hole, 1555 m, exploration diamond-drilling program was carried out on the larger Four Corners claim group. By late November, a 1220 m exploration diamond-drilling program was in progress on the Penhorwood property. Drilling results were unavailable for publication at the time of writing (The Northern Miner, George Cross News Letter, Toronto Globe and Mail, various articles, 1989; Glen Auden Resources Limited, American Barrick Resources Corporation, personal communication, 1989; personal observations, 1989).

BHP-Utah Mines Ltd.

A four-hole, 365 m, surface diamond-drilling program was completed on BHP-Utah Mines Ltd.'s Boulder Lake property in Muskego and Keith townships. Two holes tested the previously defined arsenopyrite zone at depth and two holes were drilled to test geophysically defined targets outlined in previous surveys. Results of the program are unavailable for publication (BHP-Utah Mines Ltd., personal communication, 1989).

Black Gregor Explorations Ltd.-Carlson Mines Ltd.

During the latter part of 1988, the joint venture partners carried out an extensive trenching, stripping and sampling program on their 179 unpatented claim Rollo Township property. Most of the work was carried out in the vicinity of the Aguara showing, south of Ridley Lake. An exploratory surface diamond-drilling program totalling 2438 m was subsequently completed in 1989. Gold values ranged from 3.8 g/t Au over 1.0 m to 6.9 g/t Au over 2.75 m. Gold intersections were reported in every hole (The Northern Miner, October 2, 1989, p.17; Black Gregor Mines Explorations Ltd., personal communication, 1989).

B.P. Canada Inc.

A 225 line-kilometre airborne geophysical survey was completed over the 140-claim Ross–Morin property in Reeves, Muskego and Keith townships, currently under option to B.P. Canada Inc. Line cutting, geological mapping and lithogeochemical sampling was also completed in 1989. Additional work is planned (B.P. Canada Inc., personal communication, 1989).

Central Crude Limited–Noront Resources Ltd.

A detailed 560 line-kilometre, helicopter-airborne geophysical survey was completed over four separate claim blocks in Benton, Esther, Fawn, Garnet and Osway townships. Preliminary evaluation of two claim blocks, referred to as the Osway group, included soil geochemistry and geophysical surveys.

Reconnaissance geological mapping and sampling was completed on the 20-claim Fawn Creek group in south-central Garnet Township. Base metal and precious metal targets have been defined on all four claim blocks (Noront Resources Ltd., personal communication, 1989).

Chester Minerals Limited

Early in 1989, Chester Minerals Limited completed an 11-hole, 972 m, surface diamond-drilling program on their property in Chester Township. The drilling tested the Chester main zone, located at the south end of Clam Lake, along a 122 m strike length and to a vertical depth of 108 m. Results of the drill program are unavailable (NOMINEX, personal communication, 1989).

Cominco Ltd.

Cominco Ltd. completed geological mapping and prospecting on their 25-claim property in central Cunningham Township. The property is being evaluated for its base and precious metals potential (Cominco Ltd., personal communication, 1989).

Glen Roy Resources Inc.

A nine-hole surface diamond-drilling program totalling 897 m was completed on Glen Roy's property on Clam Lake in west-central Chester Township. The drilling was focussed on the Baxter zone on Clam Lake. The mineralized zone was tested over a 150 m strike length and to a vertical depth of 125 m. Results of the drilling program were not available (NOMINEX, personal communication, 1989).

Gold Bar Resources Inc.–Murgold Resources Inc.

Late in 1989, Gold Bar Resources Inc. was granted a working option to earn a 50 percent interest in four separate claim blocks totalling 231 unpatented claims situated in Benneweis and Chester townships. Previous work by Murgold Resources Inc. identified several exploration targets on the various claim blocks. A single hole, totalling 130 m, was diamond drilled near the east boundary of one small claim block tied on to the west end of the Gold Bar Resources'–Canadian Gold Resources' Kidd joint venture property, where a major surface diamond-drilling program was in progress (*see* Advanced Exploration and Development section). The hole was completed to test an IP anomaly identified previously. Results are unavailable (Gold Bar Resources Inc., press release, September 12, 1989; Gold Bar Resources Inc., personal communication, 1989; personal observations, 1989).

Golden Dragon Resources Ltd.

Reconnaissance geological mapping and sampling was completed over 7 1/2 patented claims covering the Tionaga (Smith–Thorne) Mine in south-central Horwood Township and an additional 94 unpatented claims adjoining the property (Golden Dragon Resources Ltd., personal communication, 1989).

Grand American Minerals Limited

A program of detailed geological mapping, soil sampling and lithogeochemical sampling was completed over portions of Grand American's 17-claim property in central Cunningham Township. The detailed surveys were completed over previously outlined geophysical targets having coincident soil or lithogeochemical anomalies in zinc, copper and/or lead. In addition to assessing the base metal potential on the property, a quartz-vein with an associated arsenic anomaly was evaluated for its gold potential. Results of the recently completed program were unavailable at the time of writing (November 1989) (Mineral Exploration Management, personal communication, 1989).

Hanson Lake Resources Limited

Hanson Lake Resources Limited completed a two-hole, 365 m, surface diamond-drilling program on their 33-claim property in southeast Rollo Township. Drill targets were VLF-EM anomalies outlined previously. One anomalous intersection grading 1.6 g/t Au across 0.6 m was reported. Major rock types reported were pillowed amygdaloidal mafic flows and massive basalts cut by feldspar porphyry dikes (Hanson Lake Resources Limited, personal communication, 1989).

Jarvis Resources Ltd.

Encouraged by the initial results of the 34-hole, 2591 m, surface diamond-drilling program completed late in 1988 on the Kaplan Option property in central Mallard Township, Jarvis Resources Ltd. continued their exploration program into 1989. A detailed IP survey carried out early in the year defined a northwest-trending anomaly for 1220 m and outlined several targets for follow up. An eight-hole, 1067 m, surface diamond-drilling program tested the anomalies and found them to be pyritic iron formations carrying anomalous gold values (Jarvis Resources Ltd., personal communication, 1989).

Kirkton Resources Limited

Newly formed Kirkton Resources Limited has optioned the Shunsby property in central Cunningham Township from M.W. Resources Limited. The property, consisting of 62 patented and leased claims, hosts drill-indicated reserves of 2.177 million tonnes averaging 2.37 percent zinc and 0.39 percent copper. Small tonnage, high-grade sections are known to occur within this reserve.

Kirkton plans to re-evaluate the existing deposit and evaluate several other known mineral occurrences on the property. Much of the property is virtually unexplored.

Work on the property included reconnaissance sampling, geological mapping and prospecting. A detailed grid was cut over the entire property and geophysical surveys were to begin after freeze-up (MPH Consulting Limited, personal communication, 1989).

Landers Property

Trenching and sampling of the pyritic quartz stockworks, exposed previously on the Landers claims in Horwood Township, continued in 1989. The quartz stockworks, which are extensive, occur in chloritized pillowed basalts. Pyrite cubes, blebs and disseminations occur within the quartz and in the adjacent wall rock. Erratic but significant gold values have been reported from recent sampling (J. Landers, Prospector, personal communication, 1989).

Macjo Resources Limited

A two-hole, 86 m, surface diamond-drilling program was completed on Macjo Resources' four-claim group in south-central Osway Township. Mafic, intermediate and felsic tuffs were reported with pyritic and graphitic sections (Macjo Resources Limited, personal communication, 1989; Assessment Files, Timmins Resident Geologist's office).

Noranda Exploration Company, Limited

Detailed geological mapping and soil sampling programs were completed on Noranda's Hardiman Bay property located in east-central Horwood Township. Prior to freeze-up, a stripping program was completed over the Labbe showing as a follow up to earlier trenching by Noranda. The showing was systematically channel sampled. From earlier work, it was found that gold is associated with pyrite in silicified and carbonatized shears. The host rock consists of mafic metavolcanic rocks and coarse-grained flows or intrusions. Assay results are pending.

The Labbe showing is situated on an IP anomaly and Noranda plans to test this anomaly along trend. Other IP targets on the property will also be investigated (Noranda Exploration Company, Limited, personal communication, 1989).

Patrie Property

Initial work completed in 1988 resulted in the rediscovery of three gold occurrences and outlined numerous geophysical conductors and structures on a 45-claim property in Denyes Township. Additional claims were subsequently staked and, during 1989, an airborne geophysical survey was completed over the property. Follow-up ground evaluation of the claims resulted in the discovery of a fourth gold showing southwest of Sylvanite Lake. Gold mineralization is associated with 150°-trending structures within and adjacent to 100°- to 110°-trending regional deformation zones. To date, two zones of shearing and deformation have been recognized on the property (J. Patrie, Prospector, personal communication, 1989).

Pelangio-Larder Mines Ltd.-Bayridge Developments Inc.

The Pelangio-Bayridge property consists of 51 unpatented claims on the east shore of Horwood Lake in north-central Horwood Township. Including the Stack vein, four northwest-trending gold-bearing zones have been located, to date, on the property.

The joint venture partners undertook a surface diamond-drilling program off the ice on Horwood Lake early in 1989 to test the westward continuation of the Stack vein showing. One hole was completed and a second hole was in progress when shifting ice forced cancellation of the project. A total of 180 m was drilled. A detailed IP survey was completed during the summer field season to identify and define land-based diamond-drill targets (Pelangio-Larder Mines Ltd., personal communication, 1989).

Tarzan Gold Inc.-Noranda Exploration Company, Limited

Tarzan Gold Inc. recently added two separate adjoining claim groups comprising 156 claims to the joint venture agreement with Noranda Exploration Company, Limited, involving the Joburke Mine patents, located in Keith Township (*see* Advanced Exploration and Development section). Prior to adding the two groups to the joint venture, Tarzan Gold carried out geological mapping, sampling and ground geophysical surveys on the 59-claim Groundhog group, located on the east boundary of Keith Township. The other group, located in west-central Keith Township, is believed to be underlain by rocks similar to those hosting the gold mineralization at the Joburke Mine property, located approximately 2.5 km to the east. Additional evaluation of the two claim groups is planned (Tarzan Gold Inc., personal communication, 1989).

Tarzan Gold Inc.

Reconnaissance geological mapping and sampling was carried out as part of the preliminary evaluation of a 99 unpatented claim group situated on Horwood Peninsula in central Horwood Township. The property covers the east and west extensions of the Groundhog prospect, a narrow, high-grade gold mineralized quartz vein that averages 10.6 g/t Au across a width of 1.0 m over a strike length of 300 m. The four patented claims covering the original prospect are not part of the property (Tarzan Gold Inc., personal communication, 1989).

Teck Corporation

Initial evaluation of Teck Corporation's four separate claim blocks in Cunningham Township included line cutting, ground geophysical surveys, mapping and limited stripping and sampling. Additional work is planned (Teck Corporation, personal communication, 1989).

Timmins Nickel Incorporated–Gold Bar Resources Inc.

Timmins Nickel Incorporated optioned a 16 unpatented claim copper-nickel property, in east-central Groves Township, from Gold Bar Resources Inc. in 1989. Line cutting, magnetic and IP surveys were completed on the property to evaluate a copper-nickel deposit initially discovered in 1935. Work by previous operators during the period 1949 to 1963 outlined a small, drill-indicated, copper-nickel deposit estimated to contain 66450 t with an average grade of 1.25 percent Ni and 1.40 percent Cu. Gold and platinum values have been reported from surface sampling carried out in 1953. The drill-indicated reserves occur in two parallel, northwest-trending, north-dipping zones of sulphide mineralization approximately 15 m apart that have been traced along trend for 150 m. The zone has been drill tested to 45 m vertically and it is open at depth. A north-trending diabase cuts the east end of the mineralized zone where most of the reserves are indicated. A 1830 m diamond-drilling program is scheduled to begin before year-end to test the known mineralized zones to a vertical depth of 100 m. Timmins Nickel Incorporated will be exploring for the eastward extension of the zone as well (Timmins Nickel Incorporated, personal communication, 1989; Gold Bar Resources Inc., personal communication, 1989).

M. Tremblay

M. Tremblay holds claims covering the former Lee Lake gold mines prospect in north-central Greenlaw Township. During 1989, M. Tremblay completed a ground magnetic survey over two claims and commissioned a helicopter-borne geophysical survey over the entire claim group. Late in 1989, a detailed lithogeochemical survey was completed on the property (M. Tremblay, Prospector, personal communication, 1989).

RECOMMENDATIONS FOR PROSPECTING IN THE SWAYZE AREA

GOLD

Most of the known gold occurrences in the Swayze area are structurally controlled. Efforts should be concentrated along faults, shears and zones of ductile deformation which display silicification and/or carbonatization. Even low concentrations of sulphides (3 to 5%) within the alteration envelope are a good indication of the presence of gold. The common occurrence of quartz-feldspar and feldspar porphyritic intrusions in association with silicified and/or carbonatized structures represents a particularly good environment for gold mineralization.

The dominant trend of mineralized structures in the southeast Swayze area is 095° to 115° (i.e., Chesbar Resources–Murgold Resources No. 3 and No. 1 vein systems, Chester Township; the No. 1 and No. 2 zones on Gold Bar Resources Chester Township property; the Jerome Mine's Main and South vein zones in Osway Township; the Esther Township gold-arsenopyrite occurrence). A second, less prevalent, but equally significant, set of conjugate structures, trending 035° to 065°, has been recognized in the Chester Township area. These structures have not yet been observed outside the granodiorite-trondjhemite-quartz diorite intrusive environment that is host to all the known gold occurrences in the Chester Township area.

The Young–Shannon Gold Mine's deposit on Three Duck Lakes and Gold Bar's recently discovered No. 3 vein zone, both in Chester Township, occur within northeast-trending structures.

In the southwest, east-central and west-central Swayze area, mineralized structures have a dominant 120° to 160° trend (i.e., Patrie property occurrences, Denyes Township; Halcrow–Swayze Mine, Halcrow Township; Dyment Lake occurrence, Denyes Township; Rundle Mine, southeast Newton Township; Ferland–Gauldie occurrence, Mallard Township). Many of the more significant occurrences in these areas have a close spatial relationship to several major 110°-trending fault structures that may be indicative of regionally extensive zones of deformation.

The west-central and east-central parts of the Swayze area represent some of the least explored greenstone terrane in northeast Ontario. On-going and proposed logging activities in the area have created over 400 km of new road access since 1985. The existing and proposed new road-access corridors will provide unprecedented access to the central Swayze area making it an excellent target for exploration.

In the central and north parts of the Swayze area, two dominant structural trends have been defined: a 045° to 090° trend (i.e., Gifford prospect, Horwood Township; Tionaga Mine (Smith–Thorne) Horwood Township; Orofino Mine, southeast Silk Township; Joburke Mine, Keith Township) and a 120° to 180° trend (i.e., Marshall Minerals' Patricia zone in Keith Township; Groundhog prospect, Horwood Township; Pelangio–Larder Mine's Stack vein zone, Horwood Township). Major northeast-, east- and northwest-trending zones of ductile deformation are exposed intermittently throughout the central and north Swayze areas, but additional ground work is required to determine their regional extent. The as-yet-undefined portions of these zones of deformation make excellent targets for gold exploration.

BASE METALS

Three styles of base metal mineralization have been documented to date in the Swayze area.

1. Zinc-copper-lead mineralization is found in association with various types of iron formation where it

occurs as crosscutting veinlets and stockworks, as chert breccia cement and as massive lenses. Copper-zinc mineralization is also found in association with graphitic, argillaceous sediments at or near the contact between mafic to intermediate volcanic rocks and felsic volcanic rocks. These environments are representative of major lithofacies changes during the accumulation of the volcano-sedimentary pile. The key horizons are easily recognizable on airborne geophysical maps as linear, regionally continuous strings of EM conductors with direct magnetic correlation where iron formation is present. Graphitic horizons often have little or no magnetic correlation, occurring more often alongside an iron formation induced anomaly or within rock sequences entirely devoid of magnetic response.

The key to exploring for VMS in these environments is to determine the stratigraphic tops of the sequence hosting the iron formations and graphitic argillites.

Rocks underlying these distinctive stratigraphic marker horizons offer the greatest potential for hosting economic accumulations of copper and zinc. Key rock types include rhyolitic flows and fragmental rocks and their chloritized and/or silicified equivalents. Coarse felsic fragmental units are indicative of nearby volcanic centres which are believed to be essential as a heat source required to generate the physical processes necessary to produce VMS deposits.

2. Copper-nickel sulphides have been documented in layered ultramafic sills in Kenogaming Township, in sheared gabbro-diorites in Groves and Hong Kong townships, and in altered ultramafic flows and tuffs in Tooms Township.

Similar rock types are common throughout the Swayze area and the vast majority of them have never been evaluated for their copper-nickel potential.

In Kenogaming Township, layered intrusive rocks, pyrrhotite, pentlandite and minor chalcopyrite form the matrix of crystal cumulate layers at or near the base of peridotitic sills intruding felsic flows and agglomerates. Pentlandite is often found remobilized into later, crosscutting tensional fractures created as a result of cooling. On surface, the layering is quite obvious but sulphide stains are not always readily apparent. Anomalous platinum and palladium values are often associated with these occurrences.

Gabbro-diorite hosted copper-nickel occurrences are not well documented in the Swayze area. Descriptions of the two known occurrences in Hong Kong and Groves townships indicate nickel-copper mineralization is concentrated in shears at the footwall of a gabbro sill cutting quartz diorites and diorites. Pentlandite, millerite, chalcopyrite and pyrrhotite are the primary sulphide minerals. At the Groves Township occurrence, platinum, iridium and gold values have also been reported.

Ultramafic flows and associated fragmental rocks were first recognized in the east-central Swayze area in 1977. Their nickel-copper potential was realized at that time, but little follow-up work was ever documented. Subsequent exploration activities have resulted in the recognition of ultramafic volcanic units in the southwest, northwest, central and north Swayze areas as well.

Copper-nickel sulphide mineralization can occur within the ultramafic flow sequence where it tends to be concentrated near the base of individual flow units. More significant massive sulphide lenses, exhibiting distinctive VMS physical characteristics, tend to occur at or near the contact between older felsic metavolcanic rocks and younger, overlying ultramafic volcanic rocks. The copper-nickel massive sulphides are time equivalent to regionally continuous pyrite-pyrrhotite-chert iron formation commonly found at the contact between major volcanic rock types. The Redstone Mine in Eldorado Township, south of Timmins, is a good example of this style of mineralization.

3. Molybdenum and copper sulphides have been documented in association with quartz veins and stockworks at or near the contact between large granitic batholith intrusions and the Swayze greenstone belt. All of the occurrences documented to date are located near the contacts of the Kenogamissi batholith and one of its satellite intrusives, the Groundhog Lake batholith in Keith and Penhorwood townships. Within the Kenogamissi batholith, molybdenite and chalcopyrite occur as discontinuous sulphide bands in narrow quartz veins occupying cracks and joints in granite. More significant accumulations of molybdenum-copper sulphides occur within complex, often highly sheared, silicified and carbonatized, migmatitic, highly metamorphosed metasedimentary and volcanic rocks at the intrusive contact.

At Alike Lake in central Desrosiers Township, molybdenite occurs in pegmatite dikes cutting mafic and felsic volcanic rocks, dioritic and peridotitic intrusive rocks and younger granites. Lesser amounts of molybdenite occur in sheared greenstones adjacent to the pegmatite dikes and as disseminated segregations near granite contacts. Associated with the molybdenite are chalcopyrite, pyrrhotite, fluorite and an unidentified bismuth mineral.

A 1989 stripping program on the old Nib-Yellowknife occurrence in Keith Township by Marshall Minerals Corp. revealed the presence of significant amounts of molybdenite in quartz stockworks cutting altered ultramafic to mafic schists and dioritic to syenodioritic dikes intruding the schists. The host rocks are extensively carbonatized and hematite stained. Chalcopyrite and pyrite are commonly associated with the molybdenite.

The contact zone between rocks of the Kenogamissi batholith and the Swayze greenstone belt is extensive and there is excellent potential for additional significant molybdenum-copper discoveries along that contact.

INDUSTRIAL MINERALS

Luzenac Incorporated and Roseval Silica Incorporated are the only current industrial minerals producers (other than aggregate and sand and gravel) in the Porcupine Mining Division. Both operations are located in Penhorwood Township in the northeast Swayze area (*see* Mining Activity—Industrial Minerals section).

In addition to talc and silica, opportunities exist for the exploitation of asbestos, barite, magnesite, marl and building stone. Although no systematic studies have been carried out to determine the economic viability of the industrial minerals present in the Swayze area, the presence of these minerals suggests investigation is warranted.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The staff of the Timmins Resident Geologist's office consists of L. Luhta, Resident Geologist; P. Sangster, Staff Geologist; J. Ireland, Staff Geologist, Swayze Area; C. Hamblin, Drill Core Library Geologist; D. Draper, Data Geologist; M. Leroux, Drill Core Library Geological Assistant and D. Egerland, Secretary. During 1989, M. Bradshaw continued to work as a geologist, on a contract basis, with special responsibilities for the North Clay Belt area. Additional staffing needs were met with staff hired under the Experience '89 and Canada–Ontario Unemployment Insurance Section 25 Job Creation programs. A. Vehkala, L. Perron, A. Derosier, J. Bald and A. Zoschke were hired under these programs.

Although exploration and development activity was below the level of past years, this slow down was not reflected in the work load handled by the Resident Geologist's Staff.

The highest priority in the Timmins office during the year was to continue to provide the highest possible level of client service.

From December 1988 to November 1989, 2300 client visits to the Timmins Resident Geologist's office were recorded. This figure does not include those who participated in any of the weekend geological field tours of the Timmins area. Clients represented a broad spectrum of interests, including government agencies, exploration companies, independent prospectors, colleges and universities, tourists and interested members of the general public. These visitors came not only from across Canada and the United States, but also from Australia, Brazil, Britain, China, Finland, Germany and Thailand.

A total of 383 assessment reports and 29 Ontario Mineral Exploration Program submissions were integrated into the Resident Geologist's office files.

A great deal of the Resident Geologist's time was divided between administrative matters and responding to ministry, industry and public inquiries which remained at a high level during 1989.

As a result of a co-operative program between the Geological Survey of Canada, the Geological Survey of Finland and the Ontario Ministry of Northern Development and Mines, L. Luhta attended a geological excursion through northern and central Finland. A detailed report and slide presentation describing the significant features of the tour have been prepared.

P. Sangster acted as the Resident Geologist during his absence. Special projects in addition to office and administrative duties included: co-ordination of the Northeastern Regional Geoscience Seminar, acting as Registrar for the International Surface Crown Pillar for Abandoned Metal Mines conference, restoring the Costain Mineral Collection for the Timmins Museum and National Exhibition Centre, working with the Kapuskasing Economic Development Office to promote the use of local clays, and co-ordinating and organizing the prospecting course presented by the Timmins office in 1989. As well, 20 field tours of the Timmins area geology, 2 field tours of local clay resources, and 18 property visits were conducted. A field guide was written for the Crown Pillar Conference.

J. Ireland continued to provide a consultation service to the Swayze area client group. During the 1989 summer field season, A. Vekala, hired under the Experience '89 program, acted as assistant to the Swayze program. J. Ireland made 29 property visits to 14 different properties in the Swayze area, gave tours of the area to 7 mining industry and 2 government agency groups and attended a tour of the Cal Graphite deposit near Huntsville. A lecture and slide show were given at the Ministry of the Environment workshop in May.

A poster presentation titled "Geological Compilation of the South Part of the Swayze Belt" was displayed at the Regional Geoscience Seminar in February and at the Ontario Mines and Minerals Symposium in December 1989. The compilation is being prepared as part of the Geological Data Inventory Folio series for the Swayze area.

As Data Geologist, D. Draper was chiefly responsible for processing assessment reports. Additional projects in 1989 included conducting a geomorphology field trip and giving two geological presentations to local school groups, compiling a poster session for the Northeastern Ontario Geoscience Seminar, reorganizing the Costain Mineral Collection and acting as a guide for the Urban Planning field tour segment of the Surface Crown Pillar Conference.

M. Bradshaw was a member of the Advisory Council on Peat which was instrumental in preparing the "Peat Development Prospectus for Northeastern Ontario", released in 1989.

M. Leroux continued to act as treasurer for the Porcupine Geological Discussion Group. The group held a total of eight discussion-lecture meetings with a variety of local and international speakers, from January to November 1989.

TIMMINS DRILL CORE LIBRARY PROGRAM

During the past year, representatives of industry, government and universities made 598 visits to the Timmins

Drill Core Library. A total of 10072 m of drill core was collected. The library now has some 130416 m of drill core on file representing 519110 m of diamond drilling from 3426 drill holes. During 1989, a core telescoping program was continued to make space for newly acquired core.

Drill core was received from the following sources:

Company	Township
Aurizon Mines	Little, McCart
Black Cliff Mines	Ogden
Collingwood Energy	Greenlaw
Colt Resources	Talbot
Cominco	Bristol, Evelyn
Ebony Mines	Dundonald
Ekersval Resources	Minnipuka, Walls
Golden Pheasant Resources	Carman, Langmuir
Gowest Amalgamated Resources	Dundonald
Falconbridge Gold	Hoyle
Kukatush Mining	Penhorwood
L. Hill	Mann
Markbridge Resources	Minnipuka
QPX Minerals	Bartlett
R. MacGregor	Cunningham
Steeler Resources	Scholfield
Steetley Industries	Penhorwood
Unigold Resources	Sheraton, Bond
Ventex Energy	Sheraton, Blackstock, Thomas, Langmuir
W.O. Karvinen & Associates	Lucas

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

A detailed description of work done by the Ontario Geological Survey in the Timmins Resident Geologist's District is provided in the *Summary of Field Work and Other Activities 1989* (Ontario Geological Survey 1989).

Project 89-13: Geological Studies in the Manitouwadge–Hornepayne Area.

H.R. Williams and F.W. Breaks initiated a regional reconnaissance study utilizing litho-structural mapping techniques combined with the compilation of available geological data. The objective of the study is to increase the effectiveness of mineral exploration efforts in the area. Work to date includes the redefinition of lithologic units to form mappable units, interpretation of the deformation history of the area and the significance of deformation in relation to the geometry of Noranda Inc.'s Geco orebodies at Manitouwadge.

Project 89-06: The Geological Setting of Gold Mineralization in the Horwood Lake Area of the Swayze Belt.

G.M. Siragusa documented the geological, mineralogical and structural characteristics of several gold occurrences in the Horwood Lake area. The aim of the project, initiated in 1988, is to assist gold exploration in the Swayze belt.

Project 89-11: Geology of the Kamiskotia Area, Abitibi Subprovince.

C.T. Barrie presented an overview of the geology, tectonic setting and geochronology of the Kamiskotia area, west of Timmins, with the goal to provide assistance for mineral exploration. Emphasis is placed on establishing precise constraints on tectonic relationships in the area, which allow for time-stratigraphic correlation with other areas in the southern Abitibi Subprovince.

Program 4: Site Survey for Continental Drilling in the Kapuskasing Structural Zone.

J.T. Bursnall and D. Moser completed an extensive stripping and trenching program in two geologically critical areas within the Kapuskasing structural zone in Carty, Ivanhoe and Warren townships, southwest of Foleyet, Ontario. The program was initiated in an attempt to explain the origin of high-energy seismic reflectors beneath the Shawmere anorthosite and to determine the precise status of Ivanhoe Lake fault zone structures with regard to the Kapuskasing structural zone evaluation. The two sites are candidates for the Canadian Continental Drilling Program (CCDP), a follow-up to Project LITHOPROBE.

Project 89-48,-49: Recent Airborne Electromagnetic-Magnetic Surveys in Northern Ontario.

On June 15, 1989, the results of an airborne survey of the Detour–Burntbush–Abitibi area were released. From May to June 1988, a total of 37294 line-kilometres of data were collected using a GEOTEM time domain EM system and a Scintrex Cesium Vapour magnetometer.

In October 1989, it was announced that work had started on three new airborne magnetic and EM surveys in the Timmins Resident Geologist's District. Areas covered include: 10 townships in the Montcalm area, 15 townships in the North Swayze area and 18 townships in the Shining Tree area. Results are to be released in the spring of 1990.

RESEARCH BY OTHER AGENCIES

Watts, Griffis and McOuat Limited, began Phase III of the Timmins Hazards Program in late 1989. This phase of the program included assessment of the Dome, Preston, Pamour, Faymar and Kam–Kotia mine sites. Work consists of researching and documenting mine openings within the limits of the city of Timmins and completing site inspections wherever possible. A report detailing the results of the survey will be released in 1990 (Watts, Griffis and McOuat Limited, personal communication, 1989).

GEOLOGICAL SURVEY OF CANADA

Detailed studies of the Kapuskasing structural zone between the towns of Kapuskasing and Chapleau continued during 1989. Descriptions of the various studies are provided in Geological Survey of Canada (1989).

TABLE 12.6. MAPS AND REPORTS PERTAINING TO THE TIMMINS RESIDENT GEOLOGIST'S DISTRICT, ISSUED BY THE ONTARIO GEOLOGICAL SURVEY IN 1989.

Open File Reports

OFR 5699	Geology of Keefer, Denton, and Thorneloe Townships
OFR 5708	The Onakawana B Drillhole (OGS 85D), District of Cochrane: Report on Drilling Operations and Preliminary Geological Findings

Miscellaneous Papers

MP 141	Summary of Field Work and Other Activities 1988, by the Ontario Geological Survey
MP 142	Report of Activities 1988, Resident Geologists
MP 143	Geoscience Research Grant Program, Summary of Research, 1988-1989
MP 145	Laboratory Methods for Testing Peat--Ontario Peatland Inventory Project
MP 146	Summary of Field Work and Other Activities 1989

Studies

Study 36	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Cargill Township Carbonatite Complex
Study 37	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Clay-Howells Alkalic Rock Complex
Study 38	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Hecla-Kilmer Alkalic Rock Complex
Study 39	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Valentine Township Carbonatite Complex
Study 40	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Goldray Carbonatite Complex
Study 41	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Argor Carbonatite Complex
Study 43	Geology of Carbonatite-Alkalic Rock Complexes in Ontario: Nagagami River Alkalic Rock Complex

Open File Maps

OFM 118	Geology of Tisdale and North Whitney Townships

Preliminary Maps

P.3114	Bedrock Samples from the Sonic Drilling Program (1987) in the Matheson Area
P.3131	Precambrian Geology of the Ramore Area

Index Maps

Index to Geochemical Series Maps
Index to Geological Data Inventory Folios, Northeastern Region

Engineering and Terrain Publications

Map 5087	N.O.E.G.T.S. Hearst Data Base Map
Map 5088	N.O.E.G.T.S. Guilfoyle Lake Data Base Map
Map 5089	N.O.E.G.T.S. Opasatika Lake Data Base Map
Map 5090	N.O.E.G.T.S. Kapuskasing Data Base Map
Map 5091	N.O.E.G.T.S. Kapuskasing, Terrain Conditions for Pipeline Construction
Map 5099	N.O.E.G.T.S. Fire River Data Base Map
Map 5103	N.O.E.G.T.S. Fire River, Terrain Conditions for General Construction

Geophysics/Geochemistry Publications

Special Volume 3	Proceedings of Exploration '87: Third Decennial International Conference on Geophysical and Geochemical Exploration for Minerals and Groundwater
Maps 81171--81258	Airborne Electromagnetic and Magnetic Survey of the Detour-Burntbush-Abitibi Area, District of Cochrane

D. Moser investigated the regional extent and character of deformation phases, studied the transition from amphibolite-grade rocks of the Wawa gneiss terrane to the granulites of the southern Chapleau Block of the Kapuskasing structural zone, and documented surface structural information to aid in interpretation of LITHOPROBE seismic reflection profiles.

A.D. Leclair and G.G. Porier continued reconnaissance-scale mapping of the northern Val Rita block of the Kapuskasing structural zone. The aim of the project study was to add to the integrated data base on the Kapuskasing structural zone which will provide a more complete picture of the nature of the uplift in its entirety.

J.T. Bursnall continued detailed mapping of a section across the Archean high-grade gneisses of the southeast part of the Kapuskasing structural zone and their boundary with lower grade rocks of the Abitibi Subprovince. This work was initiated in an attempt to define the pre-uplift structural evolution of the structurally lowest part of the Kapuskasing structural zone as well as the effect and character of superimposed uplift structures.

SELECTED PUBLICATIONS RECEIVED, 1989

Barrie, C.T. and Davis, D.W. 1989. Timing of magmatism, and deformation in the Kamiskotia–Kidd Creek area, western Abitibi Subprovince, Canada; 52p.

B.C. Ministry of Energy, Mines and Petroleum Resources 1989. British Columbia Mineral Exploration Review 1988; B.C. Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Information Circular 1989-1, 45p.

Betournay, M.C. ed. 1989. Surface crown pillar evaluation for active and abandoned metal mines: Proceedings of the International Conference; 216p.

Brehaut, C.H. and Hedley, D.G.F. 1988. 1987–1988 Annual report of the Canada–Ontario–industry rockburst project; CANMET Special Report SP88-22E, 22p.

Carroll, B.M.W. ed. 1989. Preliminary review of New Brunswick's mineral industry, 1988; New Brunswick Department of Natural Resources and Energy, Mineral and Energy Division, Reference 34, 19p.

Carter, T.R. and Trevail, R.I. 1989. Oil and gas exploration, drilling and production summary, 1985; Ministry of Natural Resources, Oil and Gas Paper 8, 212p.

Energy, Mines and Resources Canada. 1989a. Gold deposits and occurrences in Canada; 144p.

——1989b. Base metal deposits and occurrences in Canada; 300p.

Geological Survey of Canada 1988. Radiogenic age and isotopic studies: Report 2; Geological Survey of Canada, Paper 88-2, 155p.

——1989. Current research, parts A through H; Geological Survey Canada, Paper 89-1, 8 volumes.

Ontario Ministry of Northern Development and Mines, Mineral Development and Lands Branch 1988. 1988 Ontario mineral score; Mineral Development and Lands Branch, 217p.

Roberts, R.G. and Sheahan, P.A. eds. 1988. Ore deposit models; Geoscience Canada Reprint Series 3, 194p.

Wawa Resident Geologist's Office Staff 1989. Mines impact database; Wawa Resident Geologist's District, 41p., 2 maps.

——1989. Provincial acts and permits applicable to the mining sequence; Wawa Resident Geologist's Office, 46p., 3 plans.

Whaley, K. 1989. Available mineral properties in New Brunswick; New Brunswick Prospectors and Developers Association, Reference 130, 53p.

SELECTED REFERENCES

Geological Survey of Canada. 1989a. Current research, part C, Canadian Shield; Geological Survey of Canada, Paper 89-1C, 412p.

——1989b. Current research, part F, national and general programs; Geological Survey of Canada, Paper 89-1F.

Ontario Geological Survey. 1988. Summary of field work and other activities 1988; Ontario Geological Survey, Miscellaneous Paper 141, 498p.

——1989. Summary of field work and other activities 1989; Ontario Geological Survey, Miscellaneous Paper 146, 275p.

Sage, R.P. 1987. Geology of carbonatite–alkalic rock complexes in Ontario: James Bay lowlands, districts of Cochrane and Kenora; Ontario Geological Survey, Study 42, 49p.

Siragusa, G.M. 1980a. Jerome area (west), District of Sudbury; Ontario Geological Survey, Preliminary Map P.2369, scale 1:15 840.

——1980b. Jerome area (east), District of Sudbury; Ontario Geological Survey, Preliminary Map P.2270, scale 1:15 840.

——1987. Geology of the Garnet Lake area, District of Sudbury; Ontario Geological Survey, Geological Report 248, 81p.

13. Kirkland Lake Resident Geologist's District—1989

G. Meyer[1], G. Grabowski[2], H. Lovell[3], D. Guindon[4] and A.C. Bath[5]

[1]Resident Geologist, Kirkland Lake Resident Geologist's Office, Northeastern Region.

[2]Staff Geologist, Kirkland Lake Resident Geologist's Office, Northeastern Region.

[3]Regional Staff Geologist, Kirkland Lake Resident Geologist's Office, Northeastern Region.

[4]Drill Core Library Geologist, Kirkland Lake Drill Core Library, Northeastern Region.

[5]Project Geologist, BRiM, Kirkland Lake Resident Geologist's Office, Northeastern Region.

INTRODUCTION

The Kirkland Lake Resident Geologist's District comprises about the northern two-thirds of the Larder Lake Mining Division. The mining division remains busy, although activity seems to have dropped from high levels achieved during the hectic "flow-through" days of the previous three years. Active claims are down to 24423, while new recordings are about the same as 1988, although down from previous years. These lower recordings are reflected in fewer man-days assessment work filed (Table 13.1).

The Kirkland Lake area was dealt a series of mining related set backs in 1989. They began with the closing of the Teck Corporation–Newfields Minerals Ltd. exploration program on the Teck-Hughes property, followed by the shut down of Toburn Gold Mines Ltd.'s attempt at reopening the Toburn Mine. Canamax Resources Inc. closed the Matheson project in Holloway Township due to disappointing results obtained on the Lower Shoot Zone. On March 6, Dofasco Inc. announced they would shut down the Adams Mine in Kirkland Lake and the Sherman Mine in Temagami on March 31, 1990. This will result in the loss of 400 jobs in the Kirkland Lake area. On June 28, 340 men at the Kerr Mine found themselves out of work when Golden Shield Resources filed for bankruptcy. Attempts to reopen the mine based on a revised ownership plan involving Armistice Resources, Deak Resources and Golden Shield should be completed in late 1989 or early 1990. The Ross Mine in Holtyre, which has operated continuously since 1936, was sold by Giant Yellowknife Mines Ltd. to Preston Electrical and Mechanical Ltd. The mine was shut down temporarily in November until the custom mill at Diepdaume Mines Ltd., the former Preston East Dome mine, in Timmins, is finished and able to handle the Ross Mine ore.

On a more positive note, LAC Minerals Ltd., Jonpol Explorations Ltd. and T&H Resources Ltd. are sinking a 500-foot shaft on the Newfield property in Garrison Township. The shaft is being sunk for bulk sampling and mineability testing of a drill-indicated gold zone. Noranda Inc. has received good drilling results on a number of joint venture properties on the Destor–Porcupine fault between Beatty and Holloway townships. Armistice Resources Ltd. is reporting encouraging results on property in McGarry Township adjacent to the Kerr Mine. In addition to underground exploration on the 2250-foot level on the Armistice property, a deal has been reached with the receivers of Golden Shield to use the 3850-foot level of the Kerr Mine to access the deeper levels of the Armistice property, where an extension of the Kerr orebody is reported to be located.

In October, the Ministry of Northern Development and Mines unveiled two new incentive programs for prospectors and companies. The Ontario Prospectors Assistance Program (OPAP) will provide prospectors with funding of up to $10000 to prospect their claims. The program was well received, with most local prospectors taking the opportunity to apply for the available funds. The Ontario Mineral Incentives Program (OMIP) will provide 30 percent of eligible exploration expenses to a maximum of $150000 per applicant per year. These programs replace the former Ontario Mineral Exploration Program (OMEP).

MINING ACTIVITY

There were ten producers in the Kirkland Lake Resident Geologist's District (Tables 13.1 and 13.2) during 1989: seven gold mines, one iron mine, one barite mine and a lizardite mineral filler mine.

American Barrick Resources Corporation

American Barrick Resources Corporation's Holt-McDermott Mine in northwestern Holloway Township for the first six months in 1989 produced 31251 ounces of gold. During this period, the mill processed an average of 1510 tons per day and achieved an average recovery rate of 94.7 percent. Cost per ounce of gold is US$283. In the second half of this year, the mine brought several new stopes into production. Drifting to the Worvest property on the 250 m and 150 m levels has nearly been completed. Development work is also continuing on the 250 m level towards the Mattawasaga Zone which was acquired from Canamax Resources Inc. in 1988. Drifting will be in the footwall of this zone and extensive underground drilling from the drift is planned for 1990. Development of additional stopes has allowed the company to increase production to a milling rate of 44000 to 45000 tonnes per month. Anticipated production in 1989 is

TABLE 13.1. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	3,511	5,239	24,423	154,099	88,288	34,941	319,325
1988	3,885	4,814	26,240	209,276	333,274	34,998	654,132
1987	6,742	3,854	27,146	197,727	319,836	17,872	600,241
1986	6,973	6,787	24,160	107,108	399,511	48,263	631,038
1985	7,558	5,011	23,974	95,076	276,646	19,517	460,183
1984	7,943	4,492	21,397	93,946	245,542	44,113	473,820
1983	8,354	3,866	17,946	121,213	98,366	15,233	304,770
1982	3,253	5,219	13,458	99,526	133,511	17,926	313,690
1981	5,498	2,697	15,423	69,906	125,459	19,536	247,087
1980	6,299	1,834	12,622	64,454	115,031	10,981	209,357
1979	4,261	1,452	8,157	29,714	25,352	4,990	68,763
1978	1,710	2,065	5,248	32,602	38,100	8,887	87,144
1977	1,826	2,334	5,703	37,101	45,436	1,820	98,992
1976	2,350	2,979	6,712	47,724	42,338	6,220	102,936
1975	2,916	5,010	7,341	45,880	38,047	6,738	98,624
1974	4,757	2,296	9,435	40,678	55,716	4,441	110,165
1973	3,260	3,214	6,974	34,113	35,811	8,150	92,616
1972	3,253	4,740	6,781	39,371	52,351	3,358	106,026
1971	4,065	3,846	8,268	29,433	48,785	4,764	96,047
1970	4,315	3,704	8,049	25,683	28,683	4,133	73,157
1969	3,404	5,273	7,438	50,892	45,713	15,829	130,185
1968	4,171	7,909	9,307	74,649	82,637	5,799	180,437
1967	5,450	7,341	13,045	79,172	29,073	4,032	143,600
1966	7,606	11,101	14,936	117,544	30,971	8,050	182,352
1965	9,331	6,906	18,431	123,129	88,259	6,530	257,029
1964	12,842	3,884	22,912	77,807	32,644	11,725	149,198
1963	4,710	3,895	13,954	95,696	16,241	4,226	138,627
1962	4,675	4,028	13,139	63,003	5,494	5,099	97,219
1961	3,749	4,451	12,492	47,862	5,494	1,118	79,219
1960	5,024	6,747	13,194	75,123	7,296	4,751	104,632
1959	6,419	5,594	14,917	22,947	3,792	1,404	80,322
1958	8,582	7,108	14,902	37,381	7,481	1,941	66,783
1957	4,664	8,212	12,618	95,934	12,593	3,948	139,891
1956	9,673	3,594	16,166	77,879	20,982	6,693	130,894
1955	4,182	3,999	10,087	75,561	3,389	3,529	105,925

75000 ounces of gold (American Barrick Resources Corporation, Second Quarter, 1989; J. Boutin, American Barrick Resources Corporation, Holt–McDermott Mine, personal communication, 1989).

Canamax Resources Inc.

At Canamax Resources Inc.'s Matheson Project, Holloway Township, a total of 38765 tonnes of ore was mined in 1988 from the Upper Shoot Zone and processed on a custom milling basis at the Cambior/Vezina mill. Mill recoveries of 90 percent were achieved and 5391 ounces of gold were produced. Continued mining of the deposit was contingent upon the results from underground drilling of the Lower Shoot Zone. Insufficient tonnage was deliniated and the decision to suspend mining was made in December 1988. Reserves of 65000 tonnes in the Upper Shoot Zone, 80 percent of which is developed, are planned to be milled at Bell Creek in late 1990 or early 1991. The Matheson site is being kept on a standby basis (Canamax Resources Inc., Annual Report, 1988).

Dofasco Inc.

Dofasco Inc. announced the closure of the Adams and Sherman iron mines effective March 31, 1990 (Northern Daily News, March 6, 1989). The loss of 339 jobs at the Adams Mine will be a major blow to the Kirkland Lake area. Normal production exceeding 1 million tons per annum of 64 to 65 percent iron-bearing pellets will continue until closure.

Eastmaque Gold Mines Ltd.

June 30, 1989, marked the first full year of operations for Eastmaque Gold Mines Ltd.'s Kirkland Lake tailings gold recovery project. Ore reserves total 8.6 million tons grading 0.033 ounce gold per ton, of which 5.6 million tons grading 0.038 ounce gold per ton are located in the present mining area. Operational problems hindered production early in 1989, however, additional dredge capacity helped boost total gold production by fiscal year end, June 30, 1989, to 17857 ounces of gold. Through the use of suction dredges, Eastmaque can reclaim tailings to a depth of 45 feet below the lake's surface. Slurried tailings are then pumped approximately 2000 feet to the company's mill, where a concentrate, containing more than 2 ounces gold per ton is produced. The concentrate is dried and trucked to a smelter in Noranda, Quebec. Eastmaque's annual target rate of gold production for the project is 23000 ounces (Eastmaque Gold Mines Ltd., Annual Report, 1989).

Extender Minerals of Canada Ltd.

Extender Minerals of Canada Ltd. produced barite from their mine and mill in Yarrow Township. Anticipated 1989 production is in the 10000 ton range. The Company plans to increase production (B. Hill, Extender Minerals of Canada Ltd., personal communication, 1989).

Giant Yellowknife Mines Ltd.–Preston Electrical & Mechanical Ltd.

The Ross Mine in Hislop Township has a three-compartment shaft to the 3300-foot level. Mining rate is 650 tons per day. Further reserves are indicated to the 5175-foot level. In 1988, a ramp was deepened to the 3375-foot lev-

TABLE 13.2. PAST GOLD PRODUCTION IN THE KIRKLAND LAKE RESIDENT GEOLOGIST'S DISTRICT (TO THE END OF 1988).

Mine	Township	Tons Milled	Production		Grade	Yrs. of
			(oz. Au)	(oz. Ag)	(oz Au/T)	Production
Aljo	Beatty	2,333	42	5	0.02	1940
American Eagle	Munro	60	40	nil	0.67	1911
Argyll	Beatty	25	30	nil	1.20	1918
Ashley	Bannockburn	157,076	50,123	7,644	0.32	1932-1936
Baldwin	Eby	81	43	81	0.53	1929,1938
*Barber Larder	McGarry	30,118	3,072	nil	0.10	1988
Barry Hollinger	Pacaud	267,741	77,000	8,502	0.26	1918,25-36,44-46
Bidgood	Lebel	586,367	160,184	72,468	0.27	1934-51
Blue Quartz	Beatty	500	81	33	0.16	1923,26,28,34
Bourkes	Benoit	1,298	277	50	0.21	1918,36-38
Canadian Arrow	Hislop	279,593	17,045	nil	0.06	1980-1983
*Canamax (Matheson Project)	Holloway	38,765	5,391	nil	0.14	1988
Cathroy Larder/Mirado Mine	McElroy	89,719	10,231	993	0.11	1941-44,47,57,87
**Centre Hill	Munro	327,007	422	36,883	.001	1967-1970
Chesterville	McGarry	3,260,439	358,880	19,371	0.11	1930-1952
Croesus	Munro	5,333	14,859	1,423	2.79	1915-18,23,31-36
*Eastmaque (tailings)	Teck	267,537	9,153	nil	0.03	1988-
Gateford (Swastika)	Teck	103,684	30,068	nil	0.29	1910-1947***
Golden Summit	Maisonville	737	57	nil	0.08	1936-37,45
Gold Hill	Catharine	4,616	660	nil	0.14	1927-28
Gold Pyramid	Guibord	175	36	nil	0.21	1911
*Holt-McDermott	Holloway	241,841	23,848	nil	0.11	1988-
Hudson-Rand	Teck	6,496	433	143	0.07	1922
*Kerr	McGarry	38,703,198	10,293,061	572,385	0.27	1911,1938-
Kerr Addison (Murphy)	Garrison	70,000	9,000	nil	0.12	1981
Kirkland Lake	Teck	3,140,283	1,172,955	130,579	0.37	1916-1960
Kirkland Townsite	Teck	4,230	1,921	168	0.45	1958-1959
Laguerre	McVittie	40,514	7,568	1,383	0.19	1937-1939
Lake Shore	Teck	17,117,923	8,573,246	1,955,132	0.50	1918-65,1982-87
*Macassa	Teck	6,465,835	2,844,847	425,417	0.44	1933-
Matachewan Consolidated	Powell	3,525,200	378,101	133,210	0.11	1934-1954
McBean	Gauthier	557,621	45,900	nil	0.08	1984-1986
Miller Independence	Pacaud	31	59	70	1.90	1918
Moffat-Hall	Lebel	16,388	4,780	1,149	0.29	1934-1935
Morris Kirkland	Lebel	127,253	16,999	29,754	0.13	1936-38,40-42
New Telluride	Skead	104	62	50	0.60	1931-1932
Omega	McVittie	1,615,081	214,098	29,290	0.13	1913,26-28,36-47
Queenston	Gauthier	1,054	177	2,380	0.17	1941
*Ross	Hislop	6,714,482	995,832	1,544,795	0.15	1936-
**Ryan Lake	Powell	184,790	1,352	36,141	0.01	1948-57,62-64
Stairs	Midlothian	15,835	3,573	1,767	0.23	1965-1966
Sylvanite	Teck	5,049,536	1,674,808	337,956	0.33	1927-1961
Teck Hughes	Teck	9,565,302	3,709,007	501,657	0.38	1917-1968
Toburn	Teck	1,186,316	570,659	135,238	0.48	1912-1953***
Upper Beaver	Gauthier	580,562	140,709	59,167	0.24	1913-1972***
Upper Canada	Gauthier	4,648,984	1,398,291	589,696	0.30	1938-1971
White-Guyatt	Munro	50	10	nil	0.20	1911
Wright Hargreaves	Teck	9,934,327	4,821,296	853,643	0.49	1921-1965
Young-Davidson	Powell	6,213,272	585,690	131,939	0.10	1934-1957
Total		120,979,072	38,174,970	7,528,144	0.32	

*Producer in 1988
**Base Metal Mine
***Intermittent Production

el, however, further deepening was curtailed due to disappointing exploration results. Reserves at the mine in 1988 were estimated at 1.055 million tons grading 0.125 ounce gold per ton (Canadian Mines Handbook 1989–90).

The Ross Mine was sold by Giant Yellowknife Mines Ltd. to Preston Electrical & Mechanical Ltd. of Timmins (The Northern Miner, June 19, 1989). The mine was shut down November 15, 1989. Tentative plans are to reopen the mine March 1, 1990.

Golden Shield Resources Ltd.

Golden Shield Resources Ltd. produced 31159 ounces of gold at its Kerr Mine operation in 1988 and 8780 ounces during the first quarter of 1989. Underground exploration work at the mine tripled reserves to 3.2 million tons of ore grading 0.123 ounce gold per ton (The Northern Miner, July 10, 1989). The company closed its Kerr Mine on June 28, 1989 when the company filed for bankruptcy. Golden Shield had run up cummulative deficits to the end of March 21, 1989, of $19.7 million. The closing of the mine resulted in layoffs of about 320 employees (The Globe and Mail, June 29, 1989, p.B15).

M. Hahn, president of Clarke, Henning and Hahn was appointed the bankruptcy trustee for the Kerr Mine. GSR Acquisition Corporation and the trustee in the bankruptcy of Golden Shield Resources reached an agreement that will give GSR access to the Kerr Mine. The second stage of the agreement calls for GSR to make a proposal to bring Golden Shield out of bankruptcy. If the creditors turn this proposal down, GSR has the option to purchase most of the Golden Shield assets (Northern Daily News, November 4, 1989).

Deak International Resources Corporation in turn has the option to acquire 90 percent of GSR Acquisition Corporation (The Globe and Mail, November 14, 1989, p.B5).

Deak Resources and Noranda Exploration have completed several property deals. Tentative plans call for combined production of 1500 to 2000 tons of zinc, copper, gold and silver-bearing ore from three base metal properties in the Rouyn-Noranda area. Subject to successful negotiations, the ore would be milled at the Kerr Mine. GSR is planning to modify one of the Kerr mill circuits to treat the base metal ores. This modification would be part of a $10 million rehabilitation package for the mill (Northern Daily News, November 1, 1989; The Globe and Mail, November 14, 1989, p.B5; Northern Daily News, November 15, 1989; The Northern Miner, November 13, 1989).

Hedman Resources Ltd.

Hedman Resources Ltd. continued to produce Hedmanite, a lizardite mineral filler from its open pit mine in southern Warden Township and its milling operation in Matheson. Ore reserves to 300 feet are over 10 million tons, sufficient to produce approximately 5 million tons of filler. Mill capacity is 300 tons per day (Canadian Mines Handbook 1989-90) and annual production is in the 4000 to 5000 ton range.

LAC Minerals Ltd.

LAC Minerals Ltd.'s Macassa ore and tailings milling operation in the first nine months of 1989 produced 60368 ounces of gold (News Release, LAC Minerals Ltd., November 6, 1989, LAC third quarter earnings). The mill has a combined capacity of 1250 tons of ore and tailings per day; 500 tons of ore from the Macassa Mine, and 750 tons of tailings from Kirkland Lake.

Underground ore reserves at the Macassa Mine on December 31, 1988, stood at proven 1.096 million tons averaging 0.49 ounce gold per ton and probable reserves at 109000 tons averaging 0.46 ounce gold per ton (Canadian Mines Handbook 1989-90). Subsequently, LAC Minerals Ltd. announced reserves on the St. Joseph and Gracie East properties, on which Queenston Gold Mines Ltd. holds a royalty interest. A total of 337400 tons grading 0.64 ounce gold per ton are indicated (The Northern Miner, February 20, 1989, p.28; February 27, 1989, p.13). In 1988, a new mineralized zone below the No. 3 Shaft and north of existing workings at the 6000-foot level was discovered (Canadian Mines Handbook 1989-90). This zone, known as the "05 Break", was explored throughout 1989.

The Lake Shore tailings gold recovery project experienced start-up problems and work is underway to adjust technical difficulties. Tailings reserves are 3.7 million tons averaging 0.076 ounce gold per ton (Canada Mines Handbook 1989-90).

A 1988 joint venture with Queenston Gold Mines Ltd. gives the company the right to earn an interest in Queenston's property, immediately west of the mine property. Three drifts were developed across the Amikougami fault. Continuation of gold mineralization along the "04 Break" was indicated, but no economical grades were found (Canadian Mines Handbook 1989-90).

Mining Corporation of Canada Ltd.

Goldpost Resources Inc. and Mining Corporation of Canada Ltd. have entered into an agreement whereby the latter will purchase Goldpost's Hislop West property. Mining Corporation, a wholly owned Noranda subsidiary, commenced production in October 1989 starting with the top levels (The Northern Miner, September 4, 1989, p.6; G. Cooper, Mining Corporation of Canada Ltd., personal communication, 1989). Mining Corporation is essentially carrying out Goldpost Resources's plan to mine about 10000 tons of high-grade ore from the Gibson West Zone lying above the 250-foot level. The drill-indicated grade of the material is 0.81 ounce gold per ton. Drilling on the West Zone returned intersections that had 0.53 ounce gold per ton across 12 feet at a depth of 600 feet and 0.43 ounce gold per ton across 18 feet at 650 feet (The Northern Miner, June 26, 1989, p.21)

ADVANCED EXPLORATION AND DEVELOPMENT

Underground exploration and development at varying stages of completion, was performed at six locations.

Armistice Resources Ltd.-GSR Acquisition Corporation

Armistice Resources Ltd. and GSR Acquisition Corporation have signed an agreement that will see $5.5 million spent on the Armistice Project over the next 18 months. Before any work can begin, GSR Acquisition Corporation must secure a lease from Golden Shield's bankruptcy trustee. By spending the 5.5 million, GSR will earn a 49 percent interest in the Armistice Project, and GSR may provide milling facilities to Armistice with both parties owning 50 percent of a joint venture on the Armistice property. Under the terms of the agreement, GSR will rehabilitate an abandoned drift at the 3850-foot level of the Kerr Mine. This drift enters the Armistice property approximately 1500 feet north of the Armistice shaft. The program calls for the drift to be extended 1900 feet and for 17000 feet of drilling. The new deal will not affect Armistice's current drilling program at the 2250-foot level. Drill-indicated reserves for the property at present stand at 500000 tons grading 0.15 ounce gold per ton (Northern Daily News, November 3, 1989).

Northfield Minerals Inc.-Rockford Minerals Inc.

Northfield Minerals Inc. has signed a deal with GSR Acquisition Corporation that will see Northfield and its associate company Rockford Minerals Inc. purchase 100 percent interest in the Cheminis project, the Fernland property and the Barber Larder property. GSR will retain 50 percent interest in nine claims adjacent to the Armistice property. This deal is subject to GSR settling with the Golden Shield Resources Ltd. creditors. If successful, work could resume at the Cheminis property early next year. Plans call for Northfield Minerals Inc. to spend approximately 4 million dollars on the property on exploration and development work. The shaft would be rehabilitated from the 860-foot level to the 1035-foot level, 2500 to 3000 feet of drifting is planned as well as 80000 feet of diamond drilling. Five known gold zones occur on the property. Zone A has approximately 60000 tons of proven and probable ore grading 0.15 ounce gold per ton. Zone B contains 35000 tons of proven and probable ore at 0.14 ounce gold per ton. Zone C has proven 270000 tons of 0.15 ounce gold per ton. Zone D has possible tonnage of 1.5 to 2 million tons of ore with 0.15 ounce gold per ton. The North Carbonate Zone, tested by 15 drill holes, is least known (Northern Daily News, November 4, 1989).

Goldpost Resources Inc.

Drill-indicated reserves on the Hislop East property are 443000 tons averaging 0.22 ounce gold per ton or 835544 tons grading 0.17 ounce gold per ton based on a cut-off of 0.1 ounce gold per ton. Several holes were drilled in the shaft area below the 450-foot level. The best intersection had 2.5 ounces of gold across a 6-foot true width (The Northern Miner, June 26, 1989).

Inco Gold Company

Inco Gold Company has prepared a feasibility report for the Anoki project, Gauthier Township. A gold price of approximately US$425 is needed before the project could be considered economic. After spending $7 million, Inco Gold Company holds a 65 percent stake at Anoki, while Queenston retains 35 percent. Mineable reserves now stand at 650000 tons grading 0.136 ounce gold per ton (The Northern Miner, June 26, 1989).

LAC Minerals Ltd.-Jonpol Explorations Ltd.-T & H Resources Ltd.

An exploration shaft on Jonpol Explorations Ltd., T & H Resources Ltd. and LAC Minerals Ltd. joint venture property in Garrison Township is being put down to a vertical depth of 500 feet for bulk sampling and mineability testing of the drill-indicated gold zone. Combined drill-indicated tonnage of three zones on this project is 1314280 tons of 0.231 ounce gold per ton.

LAC Minerals Ltd. has paid the Jonpol Group $1.3 million and is expending a further $700000 on surface exploration and metallurgical testing prior to December 31, 1989. LAC has the option to earn a 50 percent interest in this project by paying the Jonpol Group a further $1.5 million in 1990 and expending $4.7 million of exploration funds as well as one and one half times the amount of exploration funds currently being expended by Jonpol and T & H. This underground program being carried out by Jonpol and T & H will cost approximately $3 million and is being financed by "flow-through" funding (The Northern Miner, November 6, 1989).

Perrex Resources Inc.-Alberta Gold Exploration Corp.

Perrex Resources Inc. signed a letter of intent with NIM and Company, a flow-through fund, for a $500000 private placement of Perrex shares. The money will be used to fund exploration on Perrex's Iris property, Harker Township. The project is owned by Perrex with a 45 percent interest and Alberta Gold Exploration Corp. with 55 percent interest.

Previous drilling has outlined drill-indicated reserves of 1 million tons grading 0.08 ounce gold per ton. Tungsten mineralization has also been encountered. Both gold and tungsten are hosted in a syenite porphyry intrusion (The Northern Miner, September 25, 1989).

EXPLORATION ACTIVITIES

Battle Mountain (Canada) Inc.-HSK Minerals Ltd.

HSK Minerals Ltd. entered an agreement with Battle Mountain (Canada) Inc. whereby the latter may earn up to a 70 percent interest in HSK's Kirkland Lake group of properties, comprising 335 claims, by completing $4.95 million in exploration expenditures and making cash payments of $1.1 million (Canadian Corporate News, Company Announcement, June 15, 1989; The Northern Miner, June 26, 1989).

Callahan Mining Corp.-Shenandoah Resources Ltd.-Miller Independence Mining Company Ltd.-Nortek Minerals Ltd.

Callahan Mining Corp. can earn a 50 percent interest in several properties in the Boston Creek area, presently held by Shenandoah Resources Ltd. (37.5 percent), Miller Independence Mining Company Ltd. (37.5 percent) and Nortek Minerals Ltd. (25 percent) by spending $2 million over the next 15 months. The company has the option to increase that interest to 60 percent by making another $1 million in expenditures (The Northern Miner, May 1, 1989).

Chevron Canada Resources Ltd.-Stroud Resources Ltd.

Stroud Resources Ltd. and Chevron Canada Resources Ltd. have increased drill proven reserves at their Hislop property to 856000 tons grading 0.186 ounce gold per ton. The Creek Zone contains 754000 tons at 0.188 ounce gold per ton and the Main Zone located 1600 feet southeast along strike from the Creek Zone contains 102000 tons at 0.17 ounce gold per ton (Stroud Resources, News Release, June 4, 1989; The Northern Miner, June 19, 1989).

Cogema Canada Ltd.-Ameritex Resources Ltd.

Cogema Canada Ltd. countered gold values on a 312-claim property in the Burntbush River area. The property was acquired from Ameritex Resources Ltd., which still maintains an interest. The Cogema results include 0.315 ounce gold per ton across 9.8 feet and 0.175 ounce in a 5-foot section (The Northern Miner, May 22, 1989).

Goldteck Mines Ltd.-Matachewan Consolidated Mines Ltd.

Goldteck Mines Ltd. completed an option agreement with Matachewan Consolidated Mines Ltd. pertaining to 3.5 million tons of tailings at the latter's former gold producer near Matachewan (The Northern Miner, January 23, 1989). Subsequently, three series of bulk metallurgical tests were carried out. The results indicate the material is amenable to low-cost gravity separation, with recovery of gold and tungsten (The Northern Miner, November 20, 1989).

HSK Minerals Ltd.-Strike Minerals Inc.

HSK Minerals Ltd. has signed a letter of intent to earn a 50 percent stake in Strike Minerals Inc., Baden Township gold property. The property consists of 66 leased claims hosting four gold showings associated with a 3 km shear zone. To earn the interest, HSK must spend $1 million on exploration over four years, pay Strike $275000 cash and issue 500000 HSK shares (The Northern Miner, August 28, 1989).

Joutel Resources Ltd.-Mountain Lake Resources Inc.

Joutel Resources Ltd. signed a preliminary agreement to earn a 50 percent stake in Mountain Lake Resources Inc.'s, Ben Nevis Township, base metal claims. To earn its interest, Joutel has tentatively agreed to spend $1 million on exploration over four years and make cash payments of $250000. (The Northern Miner, October 2, 1989, p.24.)

Noranda Inc.-Alban Explorations Ltd.-Matachewan Consolidated Mines Ltd.

Noranda Exploration and Alban Explorations Ltd. can each earn 30 percent interest in 12 claims optioned from Matachewan Consolidated Mines Ltd. located in Hislop Township (Canadian Mines Handbook 1989-90). Alban Explorations Ltd. early this year reported the results of two drill holes of an ongoing drill program. Several auriferous zones were intersected, the best being 7.9 feet long grading 0.248 ounce gold per ton (George Cross News Letter, No. 28, February 9, 1989; Alban Explorations Ltd., News Release, February 8, 1989).

Noranda Inc.-Destiny Resources Ltd.

Destiny Resources Ltd. and Noranda Inc. released assay results from three drill holes completed on the Windjammer project, Michaud Township. Several auriferous gold zones were intersected in each hole and selected results are as follows: 4.9 feet grading 0.226 ounce gold per ton, 4.9 feet grading 0.327 ounce gold per ton, 92 feet grading 0.052 ounce gold per ton, 14 feet grading 0.125 ounce gold per ton, 112.5 feet grading 0.052 ounce gold per ton and 14.8 feet grading 0.161 ounce gold per ton (George Cross News Letter, No. 42, March 1, 1989).

Noranda Inc.-Glimmer Resources Inc.

Noranda Inc., on their 14-claim property held under option from Glimmer Resources Inc. in Hislop-Beatty townships, has intersected multiple zones of gold-bearing mineralization within the Destor-Porcupine fault. Selected intersections are as follows: 3.28 feet grading 0.57 ounce gold per ton, 3.61 feet grading 1.15 ounces gold per ton, 18.04 feet grading 0.69 ounce gold per ton, 45.92 feet grading 0.34 ounce gold per ton and 11.15 feet grading 0.43 ounce gold per ton. One of the mineralized units appears to demonstrate continuity for a 500-foot strike length. (Glimmer Resources Inc., News Release, October 10, 1989; The Northern Miner, October 16, 1989.)

Noranda Inc.-Freewest Resources Inc.

Results from deep drilling by Noranda Inc. on ground held in joint venture with Freewest Resources Inc. in the Harker-Holloway area have been announced. Three gold mineralized zones were discovered, the most significant of which is known as the Lower Zone. This zone strikes for more than 1300 feet and remains open to the east and at depth. Some of the better results from the zone include: 57.4 feet grading 0.166 ounce gold per ton, 53.1 feet at 0.215 ounce gold per ton, 54.1 feet at 0.4 ounce gold per ton and 14.8 feet at 0.32 ounce gold per ton. The zone strikes across the Freewest-Teddy Bear claim boundary. The companies are ready to commence a $2 million two-phase 40000-foot drill program (The Northern Miner, November 6, 1989; Northern Daily News, November 8, 1989).

Noranda Inc.-Freewest Resources Inc.-Newmont Exploration of Canada Ltd.-Teddy Bear Valley Mines Ltd.

The Noranda Inc. and Newmont Exploration of Canada Ltd. joint venture intersected a 41.4-foot section grading 0.271 ounce gold per ton on their Harker-Holloway property. The zone strikes across the Teddy Bear-Freewest boundary and is being tested from both sides by Noranda. Noranda and Freewest have the right to earn a 59.5 percent interest in the Teddy Bear claims divided at a 60:40 ratio, respectively. Newmont Exploration of Canada Ltd. has a 10.5 percent interest in the project (The Northern Miner, November 6, 1989, p.1).

Noranda Inc.-Lightval Mines Ltd.-Newmont Mining Corp.

A $350000 drilling program is scheduled to begin soon on 51 claims held by Lightval Mines Ltd., Harker Township. Financial backing is provided by Noranda, and Newmont continues as operator on paper (The Northern Miner, October 2, 1989).

Silverside Resources Inc.

Silverside Resources Inc. intersected a 1- to 2-foot wide kimberlite dike in a number of widely spaced drill holes on their Garrison Township project. The kimberlite dike has a strike length of 2200 feet and is open on strike and at depth (B. Gajari, Chief Geologist, Silverside Resources Inc., 1989).

Tarzan Gold Inc.-Glen Auden Resources Ltd.

Tarzan Gold Inc. completed 38 reverse circulation drill holes on claims under option from Glen Auden Resources Ltd. in Hurtubise and St. Laurent townships. All holes yielded gold, nine of the holes indicate a nearby bedrock source and one sample assayed a grade of 0.5 ounce gold per ton (George Cross News Letter, No. 39, February 24, 1989; The Northern Miner, April 24, 1989).

Tundra Gold Mines Ltd.

Tundra Gold Mines Ltd. optioned seven properties in the Kirkland Lake area. The properties are in Black, Munro, Arnold, Teck and Bernhardt townships (The Northern Miner, July 10, 1989). The first drill hole completed on their Winnie Lake property in Teck Township intersected three massive sulphide zones. The average grade for a 119.6-foot core length is 1.67 percent copper, 1.78 percent zinc, 0.332 ounce silver per ton and 0.021 ounce gold per ton. Three subsequent holes intersected several zones of disseminated mineralization (Tundra Gold Mines Ltd., News Release, October 17 and 31, 1989; G. Mullen, Consultant Geologist, Val-d'Or, P.Q., personal communication, 1989).

Unocal Canada Ltd.-Moneta Porcupine Mines Inc.-Nahanni Mines Ltd.

The Moneta-Nahanni claims, Michaud Township, adjoin each other, and Unocal Canada Ltd. has an option agreement to earn a 50 percent interest in both claim groups by spending $5 million on exploration (George Cross News Letter, No. 84, May 2, 1989). A 20000-foot drill program was recently completed. The program confirmed the presence of multiple gold zones within a syenite porphyry in contact with the Destor-Porcupine fault. The shear controlled gold mineralization has been delineated along strike for 700 feet. The deepest holes on the Main Zone to 400 feet intersected 17.7 feet of mineralization grading 0.15 ounce gold per ton, 21.6 feet grading 0.25 ounce per ton, 27.4 feet grading 0.12 ounce per ton and 7.3 feet grading 0.1 ounce per ton. In the contact zone a 22-foot section assayed 0.18 ounce per ton and a second hole cut 5.9 feet grading 0.38 ounce per ton (The Northern Miner, October 2, 1989).

RESIDENT GEOLOGIST STAFF ACTIVITIES

Classified staff of the Kirkland Lake Resident Geologist's office include: G. Meyer, Resident Geologist; G. Grabowski, Staff Geologist; F.M. Boucher, Administrative Secretary; H. Lovell, Regional Staff Geologist; D. Guindon, Drill Core Library Geologist; and M. Gaudreau, Drill Core Library Assistant at the Drill Core Library.

T. Beckett, Data Geologist, worked on contract for eleven months. M. Hill worked on the Experience '89 program at the Resident Geologist's office and D. Young worked on the same program at the Drill Core Library.

M. Woods provided geological assistance to the Regional Staff Geologist for six months on contract and a further 12 weeks on an Employment and Immigration Canada (CEIC) Unemployment Insurance Section 25 Job Creation Program.

A. Bath completed a five-year Economic Geologist program, as part of Operation Black River-Matheson, in March 1989. A final report describing more than 300 mineral occurrences has been prepared. Clerical assistance was provided by K. Rose and R. Larante, who worked on short-term contracts, and by F. Legacy and A. Levely, who worked on a CEIC Section 25 Job Creation Program.

A. Bath, as Project Geologist, began a stream-sediment survey in the Bayly Township area, following up anomalous silver-gold-nickel values identified by a lake bottom survey conducted by the Geological Survey of Canada (Hornbrook and Friske 1988). Field assistance was provided by R. Pollock via a CEIC Section 25 Job Creation Program.

The Environmental Youth Corps project was extended to March 31, 1990. The project, which is sponsored by the town of Kirkland, employed S. Grabowski, Co-ordinator; T. Corbould and S. Belanger, Environmentalists. The area around the Teck-Hughes South Shaft was cleaned up in preparation for a possible tourist attraction.

This year the Kirkland Lake Resident Geologist's office again maintained a high level of activity, providing assistance to more than 2100 office visitors. Field trips showing the local geology and mineral deposits were provided for exploration, government and university geologists as well as geologists and students from Finland, Brazil, England and the United States.

Assessment work representing 319325 man-days was added to the assessment files and more than 300 articles were added to the Technical Library.

A number of active projects and operating mines were visited by the Resident Geologist and his staff.

A six-night prospectors course was presented by the staff of the Resident Geologist and some guest speakers, with an average of 45 experienced and would-be prospectors in attendance.

Mineral potential evaluations for property rezoning, subdivisions and cottage lots were prepared at the request of the Ministry of Municipal Affairs.

In conjunction with the Ministry of Labour and the Ministry of Natural Resources, abandoned mining hazards in the Boston Creek and Kirkland Lake areas were inspected and appropriate rehabilitation recommended.

A crew of 12 Junior Rangers based at Esker Lakes Provincial Park upgraded popular field trip stops by stripping overburden, brushing trails and bleaching outcrops.

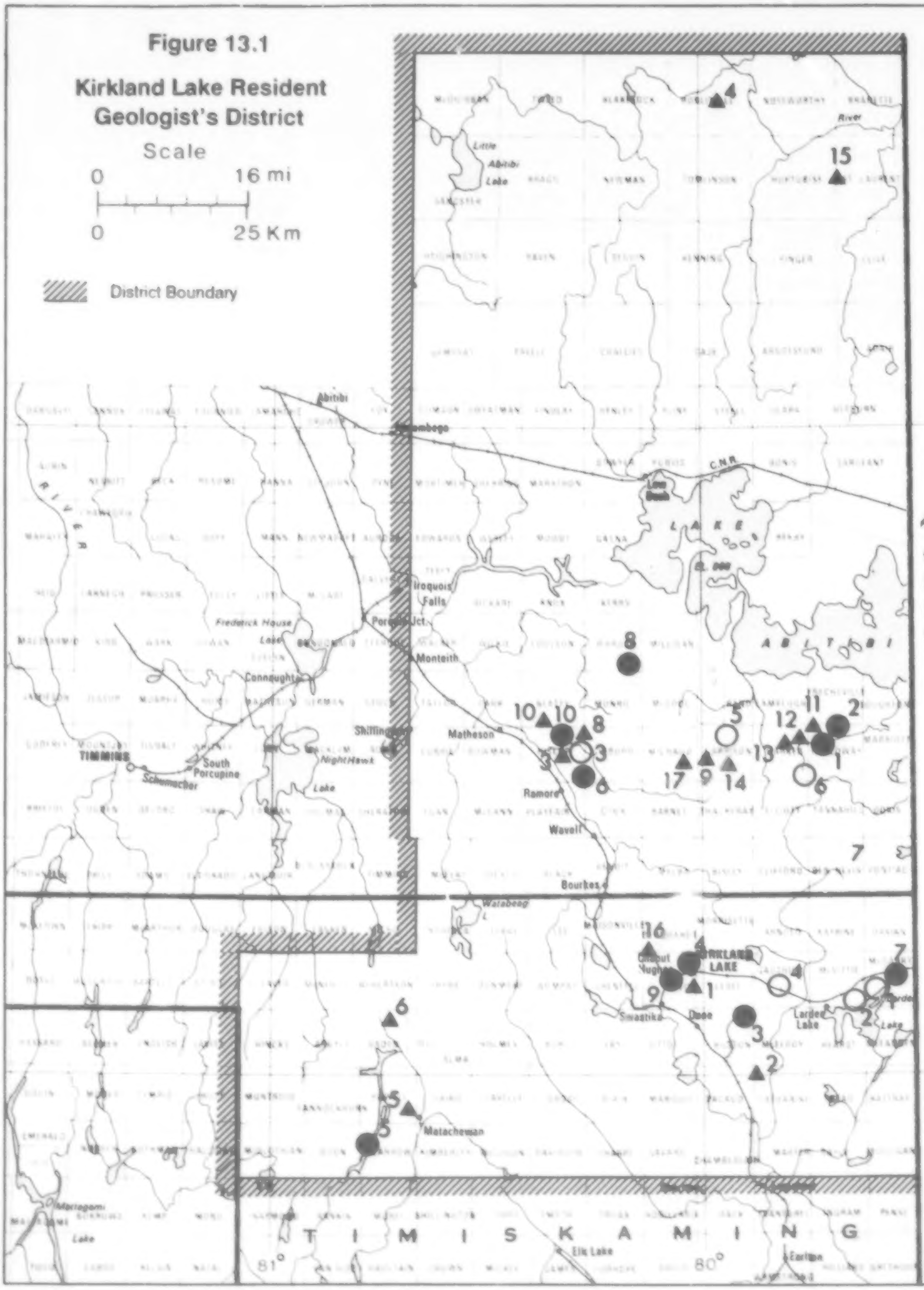


Figure 13.1

Kirkland Lake Resident Geologist's District

Scale
0
16 mi
0
25 Km
▨ District Boundary
QUEBEC
T I M I S K A M I N G
49°
48°
81°
80°
Little Abitibi Lake
River
Abitibi
Smooth Rock
C.N.R.
LAKE ABITIBI
Iroquois Falls
Porquis Jct.
Monteith
Frederick House Lake
Connaught
TIMMINS
Schumacher
South Porcupine
Night Hawk Lake
Shillington
Matheson
Ramore
Wavell
Bourkes
Watabeag L.
KIRKLAND LAKE
Swastika
Dane
Larder Lake
Matachewan
Elk Lake
Earlton
Mattagami Lake
RIVER
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

EXPLANATION

● Producing Mines

1.	American Barrick Resources Corp. Holt-McDermott Mine	Au, Ag
2.	Canamax Resources Inc. Matheson Project	Au
3.	Dofasco Inc.-Cliffs of Canada Ltd. Adams Mine	Fe
4.	Eastmaque Gold Mines Ltd. Kirkland Lake Tailings Project	Au
5.	Extender Minerals of Canada Ltd	Barite
6.	Giant Yellowknife Mines Ltd.-Preston Electrical and Mechanical Ltd. Ross Mine	Au, Ag, Cu
7.	Golden Shield Resources Ltd. Kerr Mine	Au, Ag
8.	Hedman Resources Ltd	Serpentine Filler
9.	LAC Minerals Ltd. Macassa Mine	Au, Ag
10.	Mining Corporation of Canada Ltd. Gibson West Project	Au

○ Advanced Exploration and Development

1.	Armistice Resources Ltd.-GSR Aquisition Corp. Sheldon-Larder Property	Au
2.	Northfield Minerals Inc.-Rockford Minerals Inc. Cheminis Property	Au
3.	Goldpost Resources Inc. Hislop East Property	Au
4.	Inco Gold Company Anoki Project	Au
5.	LAC Minerals Ltd.-Jonpol Explorations Ltd. Newfields Property	Au
6.	Perrex Resources Inc.-Alberta Gold Exploration Corp. Iris Property	Au, W

▲ Exploration Activities

1.	Battle Mountain (Canada) Inc.-HSK Minerals Ltd.	Au
2.	Callahan Mining Corp.-Shenandoah Resources Ltd.- Miller Independence Mining Ltd.- Nortek Minerals Ltd.	Au
3.	Chevron Canada Resources Ltd.-Stroud Resources Ltd.	Au
4.	Cogema Canada Ltd.-Ameritex Resources Ltd.	Au
5.	Goldteck Mines Ltd.	Au
6.	HSK Minerals Ltd.-Strike Minerals Inc.	Au
7.	Joutel Resources Ltd.-Mountain Lake Resources Inc.	Au
8.	Noranda Inc.-Alban Explorations Ltd. -Matachewan Consolidated Mines Ltd.	Au
9.	Noranda Inc.-Destiny Resources Ltd.	Au
10.	Noranda Inc.-Glimmer Resources Inc.	Au
11.	Noranda Inc.-Freewest Resources Inc.	Au
12.	Noranda Inc.-Newmont Exploration Of Canada Ltd.-Freewest Resources Inc.	Au
13.	Noranda Inc.-Lightval Mines Ltd.-Newmont Mining Corp.	Au
14.	Silverside Resources Inc.	Au
15.	Tarzan Gold Inc.-Glen Aulden Resources Ltd.	Au
16.	Tundra Gold Mines Ltd.	Cu, Zn, Au, Ag
17.	Unocal Canada Ltd.-Moneta Porcupine Mines Inc.-Nahanni Mines Ltd.	Au

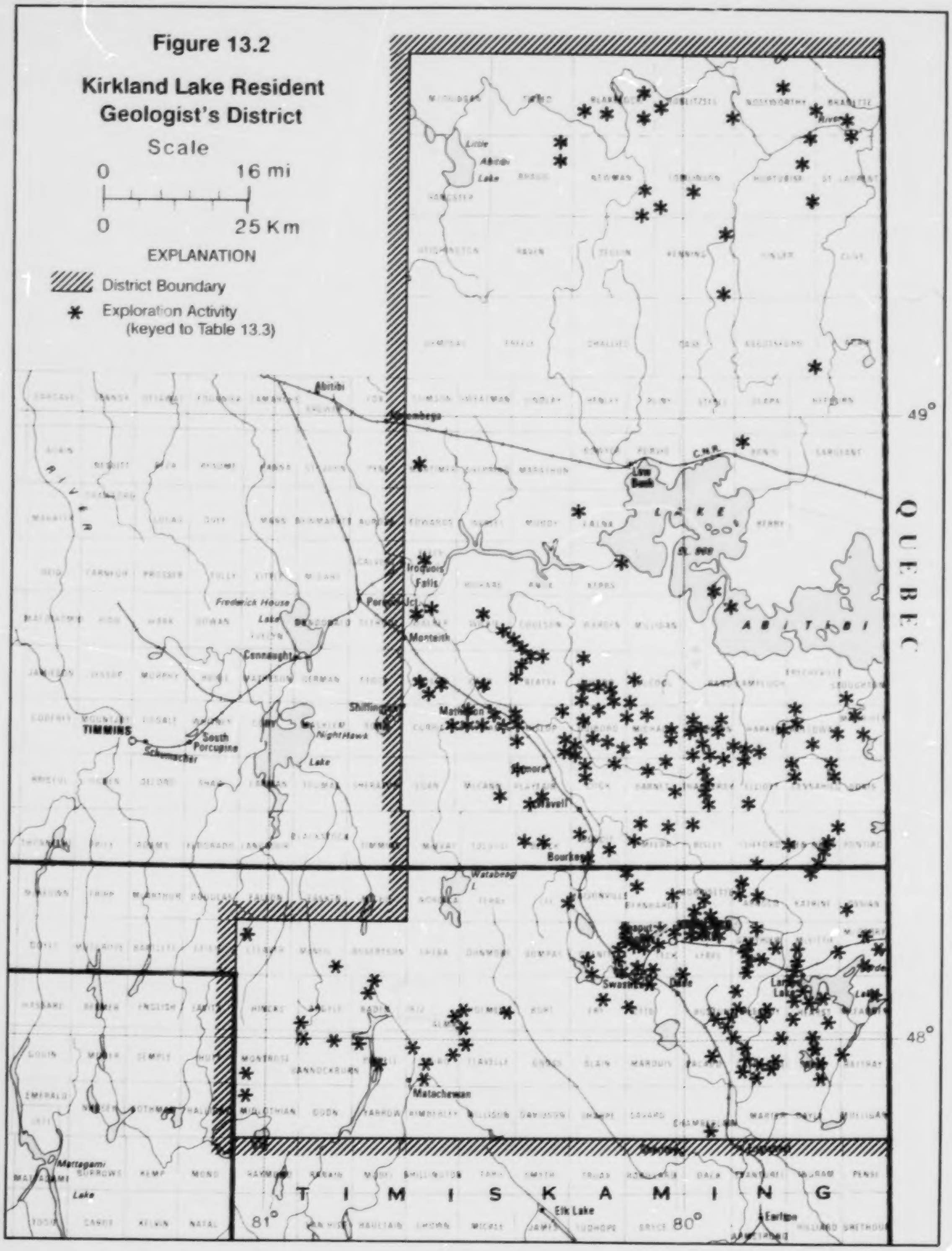


Figure 13.2

Kirkland Lake Resident Geologist's District

Scale
0
16 mi
0
25 Km
EXPLANATION
District Boundary
Exploration Activity
(keyed to Table 13.3)
Little Abitibi Lake
Abitibi
C.N.R.
Low Bush
LAKE ABITIBI
QUEBEC
Iroquois Falls
Frederick House Lake
Porquis Jct.
Monteith
Connaught
TIMMINS
South Porcupine
Schumacher
Night Hawk Lake
Shillington
Matheson
Ramore
Bourkes
Watabeag L.
Swastika
Larder Lake
Matachewan
Mattagami Lake
Elk Lake
Earlton
TIMISKAMING
81°
80°
49°
48°

TABLE 13.3. EXPLORATION ACTIVITY DURING THE YEAR.

Company Name	Township(s)	Work Reported
Accord Resources Inc.	Stoughton	Diamond Drilling (4103')
Armistice Resources Ltd.	McGarry	Underground Sampling
Asarco Exploration Co. of Canada Ltd.	Cleaver	Diamond Drilling (2542')
Ateba Mines Ltd.	McCool	Magnetic Survey, Electromagnetic Survey
BP Canada Ltd.	McFadden	Diamond Drilling (1005')
Biralger Resources Ltd.	Cairo	Stripping
Birnie, B.	Otto	Stripping
Booth, W.	Coulson	Sampling
Boudreault, B., Spadetto, G.	McGarry	Diamond Drilling (5354'),Sampling, Geology Survey, Magnetic Survey, Geochemistry Survey, Electromagnetic Survey
Brex Exploration Inc.	Cairo	Sampling, Diamond Drilling (5740')
Brex Exploration Inc.	Lebel, Morrisette	Geology Survey, Sampling, Diamond Drilling (6629')
Bruneau Mining Corp.	Munro	Magnetic Survey, Electromagnetic Survey
Campsall, L.	Coulson	Trenching
Can-Mac Resources Ltd.	Boston	Stripping, Geology Survey, Induced Polarization Survey, Sampling
Can-Mac Resources Ltd.	Boston	Diamond Drilling (307'), Sampling
Canadian Nickel Company Ltd.	Case, Kenning	Overburden Drilling (1620')
Canamax Resources Inc.	Guibord, McCool, Michaud, Munro	Induced Polarization Survey, Diamond Drilling (2003')
Canamax Resources Inc.	Marriott	Geology Survey
Canamax Resources Inc.	Munro	Diamond Drilling (3884'), Sampling
Canamax Resources Inc.	Teefy	Diamond Drilling (607'), Magnetic Survey, Electromagnetic Survey
Canhorn Mining Corporation	Ossian	Diamond Drilling (1758')
Card Lake Resources Ltd.	Black	Diamond Drilling (3412'), Sampling, Geology Survey, Stripping
Casau Exploration Ltd.	Bragg, Newman	Magnetic Survey, Electromagnetic Survey
Chevron Minerals Ltd.	Blakelock, Tweed	Geology Survey, Magnetic Survey, Electromagnetic Survey, Diamond Drilling (6580')
Cogema Canada Ltd.	Hoblitzell, Blakelock	Geology Survey
Cogema Canada Ltd.	Hoblitzell, Noseworthy	Diamond Drilling (9527'), Sampling
Cominco Ltd.	Cleaver	Magnetic Survey, Electromagnetic Survey
Cominco Ltd.	Thackeray	Diamond Drilling (3005')
Comstate Resources Ltd.	Cairo	Geology Survey, Sampling
Condaka Metals Corporation	Tannahill	Induced Polarization Survey, Diamond Drilling (2949'), Sampling
Consolidated Rio Plata Resources Ltd.	Hislop	Magnetic Survey, Electromagnetic Survey
Cook, B.G.	Catharine	Electromagnetic Survey, Sampling
Corona Corp.	Guibord, Michaud	Magnetic Survey
Cosby, M.S.	Walker	Geochemistry Survey
Coventry Ventures Inc.	Arnold	Geology Report
Cream Silver Mines Ltd.	Garrison	Diamond Drilling (3998'), Sampling
Cross Lake Minerals Ltd.	Bowman	Geology Survey
Cross Lake Minerals Ltd.	Bowman	Geology Survey
Cross Lake Minerals Ltd.	Bowman	Geology Survey
Cross Lake Minerals Ltd.	Bowman	Geology Survey
Cross Lake Minerals Ltd.	Currie	Geology Survey
Cross Lake Minerals Ltd.	Hislop	Geology Survey
Cunningham, L.J.	Holmes	Stripping, Diamond Drilling (450')
Cunningham, L.J.	Playfair	Magnetic Survey, Electromagnetic Survey
Dodd, E.	Playfair	Magnetic Survey, Electromagnetic Survey
Dufresne, R.J.	Flavelle	Stripping, Sampling
Dufresne, R.J.	Holmes	Stripping
ERG Resources Inc.	Lebel	Diamond Drilling (600')
Esso Minerals Canada Ltd.	Blakelock, Hoblitzell	Diamond Drilling (16408')
Esso Minerals Canada Ltd.	Rand	Magnetic Survey
Falconbridge Ltd.	Michaud	Diamond Drilling (2062')
Findore Minerals Inc.	Garrison	Diamond Drilling (1957'), Sampling
559505 Ont. Inc.	Thackeray	Electromagnetic Survey
587375 Ont. Inc.	Alma	Diamond Drilling (2905')
Flint Rock Mines Ltd.	Grenfell	Magnetic Survey, Electromagnetic Survey, Geology Survey, Sampling

TABLE 13.3. CONTINUED.

Company Name	Township(s)	Work Reported
Flint Rock Mines Ltd.	Grenfell, Teck	Underground Sampling, Stripping, Trenching
Forbes, C.P.	Argyle, Bannockburn, Montrose	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Fournier, E.	Wilkie	Diamond Drilling (572')
Freewest Resources Inc.	Holloway	Diamond Drilling (12776'), Sampling
Gagne, Y., St. Amand, A.	Tannahill	Diamond Drilling (701')
Gamble, S.A.	Catharine	Electromagnetic Survey, Sampling
Gateford Mines Ltd.	Teck	Diamond Drilling (680')
Giant Yellowknife Mines Ltd.	Hislop	Magnetic Survey, Electromagnetic Survey
Gibson, R.	Pacaud	Stripping
Ginn, A.P.	Carr	Electromagnetic Survey
Glen Auden Resources Ltd.	Galna, Moody	Airborne Magnetic Survey, Airborne Electromagnetic Survey
Glen Auden Resources Ltd.	Hurtubise, St. Laurent, Singer	Overburden Drilling (3964'), Induced Polarization Survey, Magnetic Survey, Electromagnetic Survey
Glen Auden Resources Ltd.	Kenning	Geology Survey
Glen Auden Resources Ltd.	Newman, Seguin	Magnetic Survey, Electromagnetic Survey
Glen Auden Resources Ltd.	Tomlinson	Sampling
Glencairn Exploration Ltd., Utah Mines Ltd.	Bernhardt	Diamond Drilling (3967')
Golden Crescent Resources Ltd.	Otto, Teck	Magnetic Survey, Electromagnetic Survey
Golden Goose Mines Ltd.	McCool, Munro	Electromagnetic Survey
Goldex Resources Inc.	Taylor	Diamond Drilling (5395'), Sampling
Gold Fields Canadian Mining Ltd.	Catharine	Diamond Drilling (2101'), Stripping
Gold Hill Mines Ltd.	Catharine	Sampling
Gold Hill Resources Inc.	Adair	Stripping
Goldpost Resources Inc.	Hislop, Guibord	Magnetic Survey, Underground and Surface Diamond Drilling (52740'), Sampling
Goldteck Mines Ltd.	Midlothian	Diamond Drilling (49531'), Sampling, Trenching, Geology Report
Grandad Resources Ltd.	Garrison, Harker	Sampling
Grandad Resources Ltd.	Newman	Diamond Drilling (2969')
Granges Exploration Ltd.	Maisonville	Diamond Drilling (2912'), Electromagnetic Survey, Sampling
Harkin, G.	Lee, Maisonville	Electromagnetic Survey
Hill, R.	Catharine	Sampling
Hobbs, L.G.	Garrsion	Diamond Drilling (866')
Horton, H.	Holmes	Stripping
HSK Minerals Ltd.	Boston, Lebel, Otto, Teck	Airborne Electromagnetic Survey, Airborne Magnetic Survey
HSK Minerals Ltd.	Guibord	Magnetic Survey, Induced Polarization Survey
HSK Minerals Ltd.	Teck	Sampling
Hudson Bay Gold Inc.	Bisley	Magnetic Survey, Electromagnetic Survey
Hurd, D.F.	Grenfell	Stripping
Hyde, D.	McCann	Diamond Drilling (100')
Imperial Gold Inc.	Skead	Geology Survey, Sampling, Magnetic Survey
Jasperson, L.	Benoit	Stripping
Jolette, R.	Ben Nevis	Diamond Drilling (1429'), Induced Polarization Survey
Joutel Resources Inc.	Beatty	Electromagnetic Survey, Magnetic Survey
Kapuskasing Resources Ltd.	Chamberlain	Magnetic Survey, Electromagnetic Survey, Geology Report
Karvinen, W.O.	Bonis, Northeast Bay, Steele	Magnetic Survey, Induced Polarization Survey
Kerr Addison Mines Ltd.	Garrison, Thackeray	Diamond Drilling (14897')
Kerr Addison Mines Ltd.	McGarry	Airborne Magnetic Survey, Airborne Electromagnetic Survey
Kiazyk, B.	Ben Nevis	Diamond Drilling (121')
Kiazyk, B.	Katrine	Diamond Drilling (213')
LAC Minerals Ltd.	Arnold	Diamond Drilling (406'), Magnetic Survey
LAC Minerals Ltd.	Clifford	Diamond Drilling (1635')
LAC Minerals Ltd.	Elliott	Geology Survey
LAC Minerals Ltd.	Garrison	Magnetic Survey, Electromagnetic Survey
LAC Minerals Ltd.	Garrison	Magnetic Survey, Electromagnetic Survey
LAC Minerals Ltd.	Garrison	Magnetic Survey, Electromagnetic Survey
LAC Minerals Ltd.	Gauthier	Diamond Drilling (1714'), Geology Survey
LAC Minerals Ltd.	McVittie	Geology Survey, Diamond Drilling (3616')
LAC Minerals Ltd.	Tannahill	Geology Survey, Electromagnetic Survey
LAC Minerals Ltd.	Tannahill	Geology Survey, Electromagnetic Survey
LAC Minerals Ltd.	Teck	Stripping, Diamond Drilling (247')
Labbe, P.	Ben Nevis	Magnetic Survey

TABLE 13.3. CONTINUED.

Company Name	Township(s)	Work Reported
Lacana Mining Corp.	Guibord, Michaud	Diamond Drilling (876'), Sampling
Lacana Mining Corp.	Michaud	Induced Polarization Survey
Lacana Mining Corp.	Powell	Electromagnetic Survey, Geology Survey, Diamond Drilling (2034')
Lacasse, L.	McElroy	Geology Survey
Lalonde, D.	Munro	Trenching, Stripping
Laverty Red Lake Minerals Inc.	McElroy	Diamond Drilling (784'), Sampling
Leahy, M.	Gauthier	Diamond Drilling Report
Leahy, M.	Lebel	Sampling
Lencourt Ltd.	Morrisette	Diamond Drilling (1788'), Sampling, Induced Polarization Survey
Link, T.	Morrisette	Diamond Drilling (1406')
Link, T., Merrick, A.	Arnold	Diamond Drilling (2080')
MacGregor, R.A.	Gauthier	Geology Survey
MacGregor, R.A.	Hearst	Geology Survey
MacGregor, R.A.	Hearst	Geology Survey
MacGregor, R.A.	McElroy	Electromagnetic Survey
MacGregor, R.A.	McGarry	Electromagnetic Survey
MacGregor, R.A.	McVittie	Sampling
MacGregor, R.A.	McVittie	Overburden Drilling (505')
MacGregor, R.A.	McVittie	Electromagnetic Survey, Magnetic Survey
MacGregor, R.A.	Skead	Geology Survey
MacGregor, R.A.	Skead	Electromagnetic Survey
Marshall, C.	Cook	Geochemistry Survey
Mary Ellen Resources Ltd.	Eby	Diamond Drilling (4008'), Induced Polarization Survey
Mary Ellen Resources Ltd.	Harker, Holloway	Diamond Drilling (6843'), Magnetic Survey, Electromagnetic Survey
Mary Ellen Resources Ltd.	Holloway	Diamond Drilling (2564')
Mathias, A., O'Connor, F.T., Porritt, I.D.	Morrisette	Stripping
Maude Lake Gold Mines Ltd.	Beatty	Core Donation
McKinnon, D.	Sulphur Island	Diamond Drilling (142')
Medici Resources Ltd.	Morrisette	Magnetic Survey, Geology Survey, Geochemistry Survey
Meunier, D.	Guibord	Geology Survey
Meunier, D.	Michaud	Diamond Drilling (3891')
Mireta Resources Ltd.	Blakelock	Geology Survey
Moneta Porcupine Mines Ltd.	Michaud	Diamond Drilling (6574')
Morrison Minerals Ltd.	Hurtubise	Diamond Drilling (346')
Morrison Minerals Ltd.	Noseworthy	Diamond Drilling (1050')
Mullan, G.J.	Bernhardt	Sampling
Mullan, G.J.	Cairo	Stripping
Neal, H.E.	Guibord	Diamond Drilling (405'), Sampling
Neal, H.E.	Marriott	Diamond Drilling (6203'), Sampling
Newfields Minerals Inc.	Teck	Diamond Drilling (48320')
Newmont Exploration of Canada Ltd.	Powell, Banockburn	Induced Polarization Survey, Magnetic Survey, Diamond Drilling (5353')
Noranda Exploration Co. Ltd.	Barnet	Diamond Drilling (408')
Noranda Exploration Co. Ltd.	Barnet	Diamond Drilling (905')
Noranda Exploration Co. Ltd.	Beatty	Magnetic Survey, Electromagnetic Survey
Noranda Exploration Co. Ltd.	Bradette	Diamond Drilling (1132') Electromagnetic Survey, Magnetic Survey, Geology Survey
Noranda Exploration Co. Ltd.	Bradette, Hurtubise, Noseworthy, St. Laurent	Sampling, Airborne Electromagnetic Survey, Magnetic Survey, Electromagnetic Survey, Diamond Drilling (4263'), Trenching
Noranda Exploration Co. Ltd.	Bradette, Noseworthy	Diamond Drilling (3008')
Noranda Exploration Co. Ltd.	Bradette, St. Laurent	Geology Survey, Geochemistry Survey
Noranda Exploration Co. Ltd.	Garrison	Diamond Drilling (3162'), Magnetic Survey, Electromagnetic Survey
Noranda Exploration Co. Ltd.	Michaud	Geology Report
Nordex Explosives Ltd.	Melba	Overburden Drilling (271')
Northcoast Industries Ltd.	Grenfell, Teck	Induced Polarization Survey, Magnetic Survey
Nova Beaucage Mines Ltd.	Teck	Diamond Drilling (500')
Obradovich, T.	Guibord	Diamond Drilling (800')
Obradovich, T.	Hislop	Electromagnetic Survey
Panthco Resources Inc.	Gauthier	Geology Survey
Pelangio-Larder Mines Ltd.	Hislop	Geology Survey
Perrex Resources Inc.	Bradette	Airborne Electromagnetic Survey, Airborne Magnetic Survey

TABLE 13.3. CONTINUED.

Company Name	Township(s)	Work Reported
Perrex Resources Inc.	Elliott, Harker	Magnetic Survey, Diamond Drilling (1309')
Perrex Resources Inc.	Harker	Diamond Drilling (1000')
Perrex Resources Inc.	Harker	Sampling, Induced Polarization Survey, Diamond Drilling (3957')
Perrex Resources Inc.	Holloway	Stripping
Perrex Resources Inc.	Thackeray	Diamond Drilling (465')
Perron Gold Corporation	Holloway, Marriott	Induced Polarization Survey
Perron, A.H.	Gauthier	Diamond Drilling (1611')
Perron, A.H.	Grenfell	Diamond Drilling (1031'), Sampling
Perron, A.H.	Munro	Diamond Drilling (2260")
Perron, A.H.	Teck	Stripping
Perron, A.H.	Thackeray	Geology Survey
Peter Island Resources Inc.	Barnet	Induced Polarization Survey, Diamond Drilling (426')
Phoenix Gold Mines Ltd.	McGarry, McVittie	Stripping, Electromagnetic Survey, Magnetic Survey, Geology Survey
Placer Dome Inc.	Blakelock	Diamond Drilling (4100')
Placer Dome Inc.	Playfair	Stripping
Premier Explorations Inc.	Bernhardt, Maisonville	Geochemistry Survey
Premier Explorations Inc.	Teck	Diamond Drilling (400')
Proteus Resources Inc.	Garrison	Diamond Drilling (3585'), Sampling
Proteus Resources Inc.	Gauthier	Diamond Drilling (1112'), Sampling, Magnetic Survey, Electromagnetic Survey, Induced Polarization Survey
R. & H. Explorations	Grenfell	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Rave Resources Inc.	Abbotsford, Adair	Magnetic Survey, Electromagnetic Survey
Regal Goldfields Ltd.	Ben Nevis	Geology Survey, Electromagnetic Survey, Magnetic Survey, Sampling, Diamond Drilling (2008')
Regent Rock Resources Inc.	Cairo	Diamond Drilling (2916'), Sampling
Regent Rock Resources Inc.	Melba	Diamond Drilling (1790')
Rodholm, C.	Benoit	Sampling
Shenandoah Resources Ltd.	Catharine, Pacaud, McElroy	Diamond Drilling (4157'), Sampling
Skead Holdings Ltd.	Boston, McElroy	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Skead Holdings Ltd.	Catharine	Electromagnetic Survey, Magnetic Survey
Skead Holdings Ltd.	Gauthier	Magnetic Survey, Electromagnetic Survey
Skead Holdings Ltd.	Hearst	Electromagnetic Survey, Magnetic Survey
Skead Holdings Ltd.	Hearst	Magnetic Survey, Electromagnetic Survey
Skead Holdings Ltd.	Hearst	Electromagnetic Survey, Magnetic Survey
Skead Holdings Ltd.	Rattray, Skead	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Skjonsby, K.E.	Benoit	Sampling, Diamond Drilling (112')
St. Andrew Goldfields Ltd.	Taylor	Diamond Drilling (surface)(31084'), (underground)(21834'), Sampling
St. Denis, R.	Mortimer	Trenching
St. Joe Canada Inc.	Melba	Overburden Drilling (1076')
Strike Minerals Ltd.	Baden	Stripping
Sudbury Contact Mines Ltd.	McElroy	Magnetic Survey, Diamond Drilling (6753'), Sampling
Sudbury Contact Mines Ltd.	McElroy	Induced Polarization Survey
Surf Inlet Mines Ltd.	Ben Nevis, Clifford	Geology Survey, Sampling
Tarzan Gold Inc.	Newman, Tomlinson	Magnetic Survey, Electromagnetic Survey
Tarzan Gold Inc.	Tomlinson	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Tarzan Gold Inc.	Walker, Wilkie	Magnetic Survey
Teck Exploration Ltd.	Catharine	Diamond Drilling (307'), Sampling
Thunder Valley Resources Ltd.	Beatty	Diamond Drilling (3136'), Sampling, Magnetic Survey, Electromagnetic Survey, Induced Polarization Survey
Trinity Explorations Ltd.	Black	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Trinity Explorations Ltd.	Teck	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Vallier, B.W.	Grenfell	Diamond Drilling (148')
Vital Pacific Resources Inc.	Kerrs, Chesney Bay	Diamond Drilling (3756'), Sampling, Induced Polarization Survey
Waband, M.	Guibord	Geology Survey
Wencarro Resources Ltd.	Bragg and Newman	Airborne Electromagnetic Survey, Airborne Magnetic Survey
Wilzel Resources Ltd.	Argyle, Bannockburn, Hincks	Geology Survey
Wilzel Resources Ltd.	Bannockburn	Diamond Drilling (621')
Wilzel Resources Ltd.	Cook	Overburden Drilling (2154'), Stripping
Winteroad Resources Ltd.	Garrison	Diamond Drilling (2628'), Sampling
Wood-Croesus Gold Mines Ltd.	Munro	Diamond Drilling (2184'), Electromagnetic Survey, Geochemistry Survey Sampling

DRILL CORE STORAGE PROGRAM

by D. Guindon

The Kirkland Lake Drill Core Library is responsible for maintaining a representative drill core collection for the Kirkland Lake Resident Geologist's District. This past year, there were 492 office visits. The library increased its collection by 3003.8 m, representing 5069.3 m of drilling. A township summary of new core appears in Table 13.4. The total collected is substantially less than in previous years. The decrease is attributed to collecting core for inside storage only.

The library stores 109856 m of core stored inside and 59283 m stored outside, representing 184060 m and 68935 m of drilling, respectively. Stored inside only is core for 1291 holes, outside only for 518 and core for 155 rotosonic drill holes both inside and outside. Core stored at the Core Library is now at 85 percent of capacity. To increase capacity and improve the collection, a program of culling repetitive sections was initiated two years ago. Freeing up of 30500 m of core space is anticipated. Thus far, 22250 m of core have been palletized and moved to outside storage. This has increased storage capacity by 10 percent. Palletized core is inaccessible during the winter.

The Drill Core Library has commenced compiling a reference collection of representative drill core and rock samples across deposits located in the Resident Geologist's District. Chemical analyses and thin and/or polished sections are planned for selected samples. The purpose of this collection is to familiarize visitors with the general geology and deposit settings in the area.

MATACHEWAN–KIRKLAND LAKE–LARDER LAKE GOLD STUDY

by H. Lovell

At the end of 1989, two and one-half years were completed of this study, the final report of which is due in 1991. During 1989, about 60 percent of the 12 months was applied to field work, including geological mapping of 65 surface, open pit and underground properties; and guiding 5 field tours. Most of the remaining 40 percent was spent doing the following: logging 85000 feet (26000 m) of diamond-drill core; cutting and polishing samples of rock and core; preparing and correlating reports, photographic slides and prints, assays, thin sections and rock samples; consulting briefly for numerous exploration and research personnel.

Of the 70 known areas and series of areas of bedrock that have undergone soil stripping, 65 were visited and described in reconnaissance fashion. One result of this study found (in Larder Lake Group conglomerate in McVittie Township) pebbles containing ore-grade gold, whereas the accompanying matrix and vein quartz each yielded only background gold values. Gold-bearing zones overlain stratigraphically by such conglomerates (those containing gold-bearing pebbles that resemble the gold-bearing zones) indicate that some concentrating of gold occurred early in the history of the host rock during sedimentation. Additional early concentrating of gold occurred by forming gold-bearing quartz veins, as indicated by pebbles of vein quartz in Timiskaming Group conglomerate in Teck Township, from which ore-grade assays were obtained.

In Baden Township, Match Capital Investment stripped across a stratigraphic sequence of intermittently gold-bearing sedimentary rocks (100 m have been exposed), where previously the thickest known sedimentary rocks were interflow types about 1 m thick.

In Eby Township, diamond drilling by prospectors F. Rivard, P. Rivard and L. Raitanen intersected 0.6 m of Larder Lake Group (Archean) conglomerate. Most pebbles are of vein quartz, quartzite and chert, and the matrix contains abundant pyrite, some of it detrital and some of it possibly precipitated *in situ*. Assays yielded only 10 to 30 parts per billion gold (approximately background for Archean sedimentary rocks, i.e., about 10 times that of most Archean igneous rocks); however, the stratum is to be investigated along strike for gold enrichment and for thickening.

STREAM SEDIMENT AND WATER GEOCHEMICAL SURVEY

by A.C. Bath

A recent lake bottom sediment and lake water geochemical survey (Hornbrook and Friske 1988) indicates that south of the town of Larder Lake in the Skead–Rattray–Bayly–Mulligan townships area there are coincident geochemical F, Fe, Mn, Mg, As, Sb, Au, V, Cu, Zn, Pb, Ag, Co, and Ni anomalies. As used here, "anomaly" refers to the presence of elemental abundances greater than those values corresponding to the 90th percentile in the survey population. Bedrock in the area consists mainly of weakly metamorphosed Archean age komatiitic, tholeiitic and calc-alkalic volcanic rocks; Proterozoic age Cobalt Group (Coleman Member) clastic sediments; and Proterozoic intrusive rocks of the Nipissing diabase. Most bedrock in the area is mantled by glacial deposits of Quaternary age. Several base and precious metal prospects and occurrences are within the geochemically anomalous area as well as to the north (up-ice and up drainage from the geochemically anomalous area) where, in addition, deposits and mines occur.

During the 1989 field season, follow-up stream sediment and stream water sampling was undertaken in Skead, Rattray, Bayly and Mulligan townships and to the north and west in Gauthier, McVittie, McGarry, McElroy, Hearst, McFadden and Catharine townships. The purpose of this survey was twofold:

1. to produce a higher sampling density follow-up survey of a geochemically anomalous area for the purpose of identifying high potential base and precious metal exploration areas
2. to establish the efficacy of stream water and stream sediment sampling media to detect (in a glacial drift covered area) known occurrences of anomalous base and precious metal mineralization

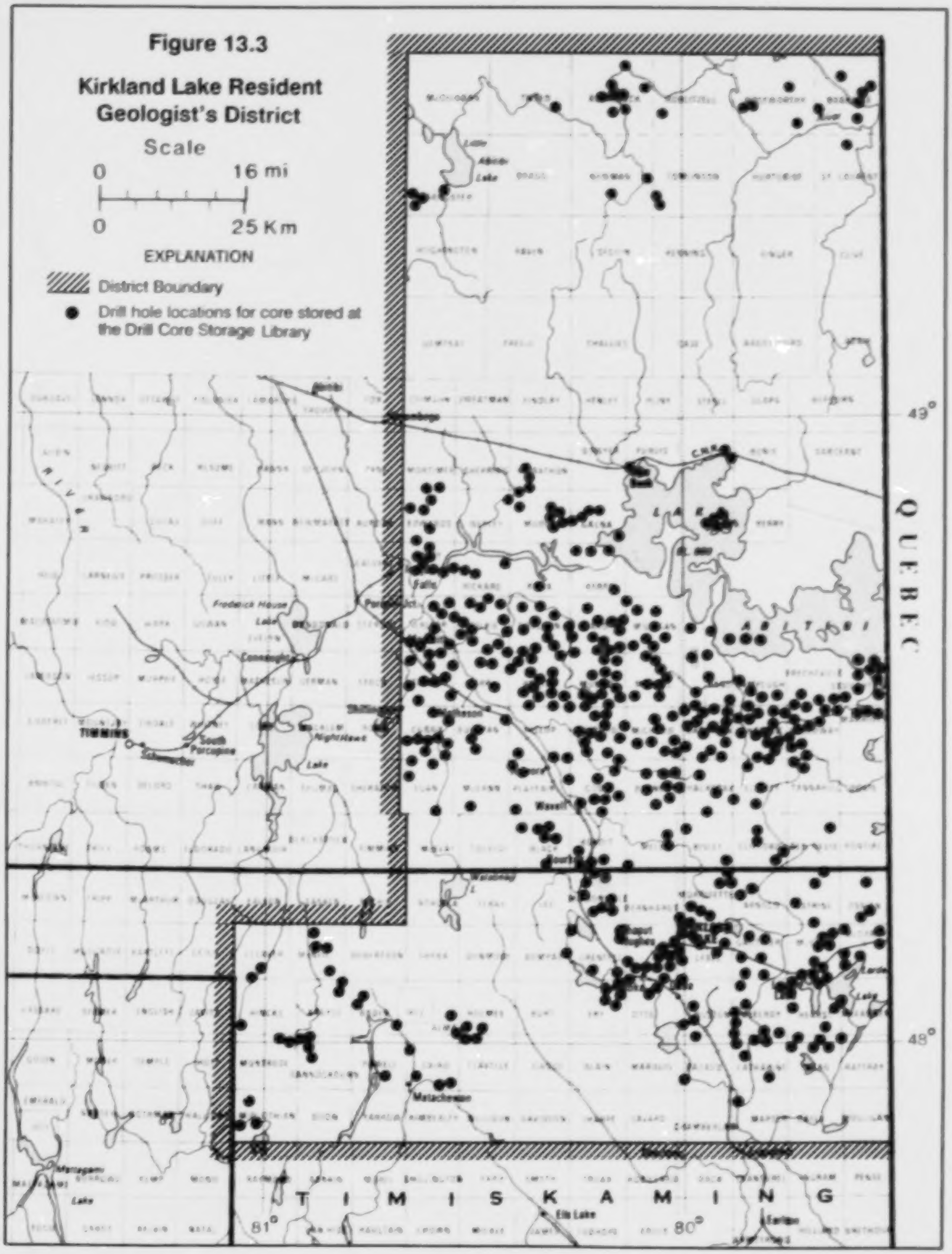


Figure 13.3

Kirkland Lake Resident Geologist's District

Scale
0
16 mi
0
25 Km
EXPLANATION
District Boundary
● Drill hole locations for core stored at the Drill Core Storage Library
QUEBEC
TIMISKAMING
49°
48°
81°
80°
TIMMINS
South Porcupine
Schumacher
Frederick House Lake
Connaught
Night Hawk Lake
Matachewan
Abitibi Lake
Wavell
Elk Lake
Earlton
Matheson
Lake Abitibi

TABLE 13.4. SUMMARY OF CORE COLLECTED SINCE NOVEMBER 1, 1988.

Township	Number of Holes	Total Depth (m)	Core Stored Inside (m)	Core Stored Outside (m)
Alma	1	92.0	1.5	0.0
Barnet	3	825.9	794.9	0.0
Beatty	4	570.6	25.0	0.0
Bowman	1	448.1	404.8	0.0
Currie	3	693.0	494.0	0.0
Guibord	2	243.8	104.5	89.9
Hearst	1	82.9	82.9	0.0
Lamplugh	2	474.3	290.8	0.0
McNeil	1	200.3	196.9	0.0
Moody	2	282.9	106.7	0.0
Ossian	1	154.2	150.0	0.0
Rand	1	203.0	150.9	0.0
Teck	2	798.3	200.9	0.0
TOTAL	24	5069.3	3003.8	89.9

A two-man field crew provided by the Kirkland Lake Resident Geologist's office collected 237 stream sediment and stream water samples (including control reference and blind (analytical) duplicate samples) representing 200 sampling sites. Of the 200 stream sites sampled, 129 were on primary streams, 58 were on secondary streams, and 13 were on tertiary or larger class streams. Sampling was at an average density of 1 sample per 4.6 km^2 throughout a 920 km^2 area. Over the course of the field season, on average, stream sediment and water were sampled at 4 sites per field day.

Sample preparation, multielement geochemical analysis, statistical analysis and survey compilation and publication will be by the Geological Survey of Canada. It is anticipated that the survey publication format will be similar to that used for the reconnaissance lake bottom sediment and lake water survey (Hornbrook and Friske 1988). The expected survey release date is during 1990.

RECOMMENDATIONS FOR BASE METAL EXPLORATION

Grunsky's (1986) volcanic rock geochemical data for the Ben Nevis Township area contains some soda-depleted and magnesium-enriched samples. This type of depletion and enrichment is typical of hydrothermal alteration of volcanic rocks altered during massive sulphide formation. Although samples displaying evidence of hydrothermal alteration have haphazard distribution, some clustering is evident. Further sampling in selected areas is required to define some of the alteration zones already indicated. Hydrothermal alteration zones in conjunction with stratigraphy and structural interpretations would then help identify selected horizons with high base metal potential.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

Detailed information on the following projects can be found in *Summary of Field Work and Other Activities 1989* (Colvine et al. 1989).

PRECAMBRIAN GEOLOGY SECTION

S.L. Jackson continued a study of the structure and stratigraphy of the Abitibi greenstone belt. Mapping during the summer was confined mainly to the Boston Creek area in Boston, Pacaud, McElroy and Catharine townships.

D.G. Troop investigated the Destor–Porcupine deformation zone east of Matheson in Hislop, Guibard and Michaud townships.

GEOPHYSICS/GEOCHEMISTRY SECTION

An airborne magnetic and electromagnetic survey carried out by Geoterrex Ltd. in the Detour–Burntbush–Abitibi area was released on June 15, 1989.

An airborne magnetic and electromagnetic survey also carried out by Geoterrex Ltd. in the Shining Tree area which includes the area southwest of Matachewan, will be released in the summer of 1990.

RESEARCH BY OTHER AGENCIES

UNIVERSITIES

Queen's University

W. Powell and C.J. Hodgson completed work on the structual expression of the Larder Lake break in the Proterozoic sediments near Matachewan.

University of Toronto

J.P. Smith and E.T.C. Spooner studied the ore controls in the Kerr Addison–Chesterville gold system.

Technische Universitaet Berlin (West Germany)

B. Klimm sampled graphite from area deposits including Kidd Creek Mine, Kerr Mine, Lake Shore Mine and Asarco's Currie Township property to determine any organic origin of the contained carbon.

REFERENCES

Colvine, A.C., Cherry, M.E., Dressler, B.O., White, O.L., Barlow, R.B. and Riddle, C. eds. 1989. Summary of field work and other activities 1989; Ontario Geological Survey, Miscellaneous Paper 146, 275p.

Grunsky, E.C. 1986. Recognition of alteration and compositional variation patterns in volcanic rocks using statistical analysis of lithogeochemical data, Ben Nevis Township area, District of Cochrane, Ontario; Ontario Geological Survey, Open File Report 5628, 187p.

Hornbrook, E.H.W., and Friske, P.W.B. 1988. Regional lake sediment and water geochemical reconnaissance data, Gogama area, Ontario; Geological Survey of Canada, Open File 1640, 126p.

14. Cobalt Resident Geologist's District—1989

L. Owsiacki[1], M. Cosec[2], D.P. Anderson[3], E.M. Basa[3] and P. Born[3]

[1]Resident Geologist, Cobalt Resident Geologist's Office, Northeastern Region.

[2]Staff Geologist, Cobalt Resident Geologist's Office, Northeastern Region.

[3]COMDA Geologist, Cobalt Resident Geologist's Office, Northeastern Region.

INTRODUCTION

As predicted last year, exploration activity fell precipitously during the year, and mining development ground to a near halt. A serious erosion in the price of silver and gold contributed to an already depressed exploration environment established in the previous year through the demise of flow-through share funding and the stock market crash. Although a November rally in the price of silver (US$5.75) and gold (US$405.00) has generated a minor revival of exploration in the area, the impending closure of two iron mines and total suspension of silver production for the first time in Cobalt's history will lead to a very significant drop in the value of commodities produced in the area in 1990. The continued effects of an Indian land claim severely restrict the future potential for new discoveries to replace recently closed mines.

Some of the more important positive developments to take place during the year include: the continued feasibility study of the formerly producing copper-nickel Kanichee Mine near Temagami by J.P. Sheridan companies; the continued exploration and development of Agnico–Eagle Mines Limited's Penna Mine, located on the north shore of Lake Timiskaming; continued exploration at the Leroy silver property near Gowganda, under the direction of the Lucky Eagle Mines Limited joint venture (Agnico–Eagle Mines Limited and Hecla Mining Co.); the expansion of Dymond Clay Products Limited quarrying operations and this same company's plans to construct a new quicklime plant in the area; and new expanded operations at the Cobalt Refinery.

Major negative developments by year-end included the closure of the Beaver–Temiskaming Mine and the suspension of underground exploration at the Leroy Shaft; the closure of the Conisil Mine after shaft rehabilitation was completed and plans made to mount a major underground exploration program; and the announced closure of the Sherman Mine in March 1990. In addition, Agnico–Eagle Mines Limited terminated approximately 75 percent of their area employees, closed the mill and prepared the refinery for indefinite neutral status. Two small regional offices for A.C.A. Howe International Limited and Breakwater Resources Ltd. were also closed during the year. In addition, continuing restrictions on claim staking over much of the area, due to a long-standing land claim by the Bear Island Indian Band, remained in place. This claim has effectively stifled exploration for the past two decades. The Supreme Court of Canada granted the Band leave to appeal their case.

Prices for most commodities mined in this area resumed their downward trend as silver declined again by 15 percent to a level near US$5.25 for most of the year, although a late November rally brought the price up to US$6.00 at the time of writing. Relative increases or decreases in metal production during the year varied depending on the commodity. Silver production declined by 40 percent to 869 888 ounces from five area mines, whereas iron pellet production increased by 9 percent to 980 440 tonnes (t). Included in the five area silver mines total was production from stockpiles of the Hellens–Eplett Mine, Mann Mine, Conisil Mine, Langis Mine and Beaver–Temiskaming Mine. Production of metallurgical limestone declined by 14 percent to 144 136 t, while building stone production was maintained at levels comparable to last year. In addition, quarrying of albite was initiated at a small quarry during the year. At the Cobalt Refinery, recovery of ferric sulphate increased dramatically this year to 1.5 million gallons from 120 000 gallons in 1988, and new product lines resulted in additional production of 4000 gallons of ferrous chloride and 3 t of copper. Substantial quantities of sand and gravel were also extracted in the area. Cobalt, copper and nickel were mined together with silver but not recovered. The estimated total gross value of minerals extracted in the area during 1989 rose by 2 percent to approximately $71.5 million. Unfortunately, this number represents the peak for the foreseeable future and will fall dramatically in 1990 and 1991 with the suspension of iron and silver production in the area.

MINING ACTIVITY

Beaver–Temiskaming Mine (Agnico–Eagle Mines Limited)

In November 1988, all exploration and mining operations were terminated as the company rationalized its operations. Ensuing work consisted solely of pulling broken ore stockpiled in numerous stopes. All stopes were pulled by the end of April 1989, and the mine made ready for final closure. Air and water lines were salvaged where possible and ventilation tubing removed. The pumps were subsequently removed and the mine allowed to flood.

During 1989, 11 581 tons of ore, containing 156 343 ounces of silver, were hoisted to surface exclusively from stopes above the 1330-foot level in the Cobalt Lode area. Totals of 57 percent of this material and 51 percent of the silver were obtained from four stopes on the No. 56 vein system. These stopes are all interconnected. The No. 37S vein system, also penetrated by four stopes, produced 39 percent of the ore and approximately 44 percent of the silver. The remainder of the ore was obtained from a small high-grade sub-stope off the No. 37N vein and a small, very low grade stope on the No. 61 vein used to access another stope. In total, production decreased by 14 percent, while the number of ounces of silver contained in the ore decreased by 53 percent.

No further exploration or development work was carried out on the property. Plans to extend the 1363 drift, with exploration crosscuts from the Brady Lake workings, north-northwestward to connect with the Conisil Mine workings, were cancelled.

Sherman Mine (Dofasco Inc. and Tetapaga Mining Company Limited)

Low production figures in 1988, due in large part to labour difficulties, were increased in 1989 with a 9 percent rise in iron pellet production to near normal levels of close to 1 million t. In late December 1988, a waterline break affected milling operations, as did an electrical fire in the control panel of the concentrator plant in late January 1989. Neither of these events resulted in lay-offs. The mine was also shut down during the last week of July and most of August for the company's annual five-week vacation period.

During the year, 970318 t of iron pellets were produced from 4013358 t of crude ore. Mining of waste rock decreased by 26 percent to 1.52 million t. The average stripping ratio at the mine was 0.41 compared to 0.59 in the previous year. Fifty percent of production was derived from the West Pit, where several of the benches were removed and the pit deepened, especially in the central portion. Production at the main East Pit remained fairly constant at 40 percent of the mine's ore. Development activities at the Turtle Lake Pit were reduced and provided the remaining 10 percent of the total ore (S. Bartle, Cliffs of Canada Limited, personal communication, 1989). This lack of continued development at the Turtle Lake Pit may be due, in part, to the announcement by Dofacso Inc. to permanently close both the Sherman and the Adams iron ore mines on March 31, 1990. Uneconomically low grades are cited as the main cause. Actual mining of ore should be complete by February 1990, as the last trainload of concentrate pellets is expected to be shipped to Hamilton within two or three days of the closings. The shut-down will effectively result in the lay-off of all but approximately 50 of the Sherman Mine's current workforce of 342. The remaining employees will continue to work for several months in de-commmissioning the site. The steelmaker has offered its employees a relatively attractive severance package.

Bucke Quarry (Dymond Clay Products Limited)

Mining operations continued throughout the year, although production decreased modestly as two major clients prepared for permanent shut-downs in March 1990. The quarry presently operates continuously, although only crushing, loading and trucking take place during a period of four months in the winter. At present, flux material, destined for two area iron mines, is crushed to gravel size on the pit floor and trucked directly to the mines where it is crushed to smaller sizes. Metallurgical-grade material, destined for the Kidd Creek smelter in Timmins, is crushed to gravel size on the pit floor. The material is then transferred by loader to a drying furnace and subsequently travels by conveyor to a storage cone. From the cone, it is transferred by conveyor to a tertiary crusher where it is reduced to -50 mesh and conveyed to a loading hopper.

During the course of the year, Dymond Clay Products Limited continued its exploration and development efforts aimed at finding additional material, and developing new products, which might replace the significant tonnage losses expected next year when two local iron mines close. Significant progress was made as a new deposit was delineated and preparations made to begin a major new quarry. The proposed Breault Quarry, located in Dymond Township, was first discovered last year when the company followed up on results from a Ministry of Northern Development and Mines (MNDM) drill hole put down as part of an economic evaluation of the Lake Timiskaming Paleozoic Outlier (Grant and Owsiacki 1987). In 1988, Dymond Clay Products Limited completed drilling of 12 vertical holes and outlined a deposit area of approximately 60 acres. In 1989, geological mapping, minor stripping and trenching, and sampling were completed on the property. The company has since entered into a mineral extraction agreement with land holders and is awaiting final permit approvals before mining can commence, tentatively in early 1990. The operation is designed to be of similar size to the presently producing Bucke Quarry, and the material is intended as feed for a new product line, for which a facility is now under construction.

To parallel this development, the company completed a feasibility study into producing and selling quicklime, and has since poured the foundation for a significant new plant in the area. Six large product silos are now on the site, in addition to material-handling equipment, a truck-loading hopper and kiln shell. Construction is slated for completion by April 1990.

The company also continued to add to land holdings adjacent to the Bucke Quarry in Bucke Township.

Production decreased by 13 percent from 1988 to approximately 144000 t during 1989. Of this total, 65 percent was sold to the Sherman and Adams iron mines as flux limestone, 7 percent was metallurgical limestone sold to the Kidd Creek smelter, 28 percent was sold as aggregate and armourstone, and less than 1 percent was used as agricultural limestone.

McLaren's Bay Mica Stone Quarries (G. Boughner)

Quarrying of decorative building stone from this property totalled approximately 7500 t; an amount similar to that extracted in 1988. The quarry is located on the north shore of Reynolds Lake in the southwestern portion of McAuslan Township. It consists of numerous shallow pits distributed over a long strip of land covering 23 km². Each individual pit, although mineralogically distinct, is underlain by micaceous quartzites and muscovitic gneisses which represent the two predominant rock types in this area. Various colours of stone are quarried. The variation in colour is due to the variety and concentration of mica within the rocks. The most popular colours of stone produced are distinctive green or red colours, but both black and "satin" varieties are also sold. The black stone (quartz-biotite gneiss) is present in only one location and has recently increased in popularity. "Satin stone" is defined as a coarse, irregular-textured quartzose gneiss. These, and other varieties of stone, are crushed to sizes ranging from 5 cm to -50 mesh. This material is used as ornamental landscaping gravel and is also being marketed for use as a metallic paint additive. The stone is distributed to markets in Montreal, Toronto and the United States.

Thorne Brilliant Stone Quarry (P. Pharand)

This quarry is located in the northern half of Poitras Township, near the town of Thorne, Ontario. The company produced approximately 500 tons of decorative building stone and flagstone in 1989. This represents a level of activity similar to that of 1988. The property is characterized by the presence of extensive outcrop, but actual quarrying is restricted to three main areas. Underlying rocks consist predominantly of quartz-muscovite gneisses. Minor quantities of black stone, consisting of biotite gneiss, are also quarried. The stone is broken into slabs, varying in thickness from 3 to 30 cm, although the most commercial thickness is in the range of 5 to 15 cm. Slabs larger than this are difficult to market. Distribution of the product, advertised as flat or wavy patio stone and flagstone, is predominantly to local markets in Ontario and Quebec. The owner recently purchased a large rock saw and intends to begin producing brick forms during the winter months.

MILLS AND REFINERIES

Penn Mill (Agnico-Eagle Mines Limited)

This mill operated continuously throughout the year, processing ore from the Beaver-Temiskaming silver mine. In addition, stockpiled ore was milled from the recently closed Langis and Conisil mines and custom ore from the Hellens-Eplett and Mann mines. The mill ran at approximately 90 percent of design capacity, handling 270 to 280 tons per day. The mill was indefinitely closed on October 2, 1989, due to declining silver prices. It may be reopened for a two-month period later this year to custom-mill gold ores from outside the area.

The company also continued evaluating the Nipissing tailings deposit for possible future recovery, by completing an auger sampling project and subsequent leachate toxic tests on the material. Environmental consultants were hired to assist in an audit of area holdings and to investigate the possibility of adding the Kerr Lake basin as an additional tailings depository. Projects involving improvements to the Glen Lake tailings area were postponed (Owsiacki and Anderson 1988).

Agnico-Eagle Silver Refinery (Agnico-Eagle Mines Limited)

This refinery operated continuously throughout the year, processing concentrate from the company's mill as well as custom-refining concentrate from the Hellens-Eplett and Mann mines. In addition, ores from potential new custom-refining clients were evaluated, but tests proved that cost-effective processing was not feasible.

The company also began carrying out numerous pre-closure activities which included: 1) a significant clean-up of the refinery yard in an effort to make it environmentally secure; and 2) steps to safeguard a 15000 ton stockpile of leach residue. This leach residue was first moved last year to an outside storage location in the general vicinity of the Beaver-Temiskaming Mine. Since then, the old Canadaka Mill building was purchased from Breakwater Resources Ltd. and will be used for permanent storage of this material. Currently, the material is being moved to this site since earlier efforts to sell the residue proved fruitless.

In addition, various research-oriented projects were continued or postponed. The Linde Division of Union Carbide Canada Limited carried out tests in 1988, using oxygen in an attempt to improve extraction rates. The results were encouraging enough for Agnico-Eagle Mines Limited to evaluate the process at a full plant scale test in 1989, but this component of the project was subsequently postponed. Inco Limited was also retained last year to evaluate a sulphur dioxide process which might assist in cyanide destruction. Flow sheets for the system have now been developed, and Agnico-Eagle Mines Limited hopes to evaluate the system in 1990. The company also hopes to evaluate the new deGussa peroxide system for cyanide destruction in 1990. The refinery ceased activity at the end of November 1989, and will be maintained on an indefinite neutral status.

Cobalt Refinery (Cobalt Refinery Limited)

The refurbishing of several buildings was continued during the year. Both interior and exterior renovations of a carpentry shop were completed and the interior of a storeroom and shop were repaired and insulated. A general clean-up of the plant and site was also continued throughout the year and the clean-up and removal of remaining ferrous arsenate dumps were approved by the Ministry of the Environment.

The name of the company was changed from XIB Resources to Cobalt Refinery Limited, and the company's workforce increased to 17 employees.

An experimental electrowinning process is now being used to extract ferrous chloride and copper from electrical circuit etchants. After processing, the bulk of the ferrous chloride is trucked to either Montreal or Toronto to be converted to ferric chloride. The extracted copper is sold to the Noranda Inc. smelter in Noranda, Quebec, for future recycling. The process is uneconomical at this time, but with the considerable research completed this year, the company expects to be able to recover the copper and ferrous chloride economically by early 1990. Approximately 3 t of copper and 4000 gallons of ferrous chloride solution were produced this year using this process. By 1990, the figure is expected to rise to 3 t of copper and 4000 gallons (or 30 t) of ferrous chloride solution per week.

The bulk of activity in 1989 still centred on the production of ferric sulphate from ferrous sulphate crystals obtained from Sidbec Incorporated in Montreal and other sources in Quebec, Ontario and parts of the United States. A major accomplishment for this company in 1989 was the automation of this process and the installation of a reactor tower. Ferric sulphate is used for water clarification and as a sedimentation agent in sewage treatment plants. The company is also hauling a large amount of mine waste for removal of arsenic and antimony using the same process of chemical precipitation. Approximately 1.5 million gallons of ferric sulphate were produced this year and sold in Ontario, Quebec and several areas in the United States (as far away as Louisiana and Mississippi). Cobalt Refinery Limited's largest market is in Michigan.

ADVANCED EXPLORATION AND DEVELOPMENT

Penna Mine (Agnico-Eagle Mines Limited)

Following completion of the Penna shaft in late 1988, an extensive program of crosscutting, drifting and underground diamond drilling was initiated. This was carried out in an effort to follow up on earlier high-grade silver intersections suggestive of a potential new mineable orebody. The shaft was collared in Nipissing diabase and extends down through a thick sequence of pebbly wackes of the Huronian Coleman Member into a basement of Keewatin (Archean) mafic metavolcanic rocks. It is centrally situated within a northeasterly trending paleotrough which may represent a Keewatin-age graben. Potential vein systems may have developed over the two flanks of this paleostructure. Significant high-grade silver intersections have been obtained from within all three rock types at the western margin of this trough. Presently this is the principle target for investigation.

Both exploration and development during the year were concentrated on the fourth level. The 4-1 crosscut, started last year, was extended from the shaft at a bearing of 305° for a distance of 2160 feet. At this point, the unconformity between steeply dipping, sheared Keewatin mafic metavolcanic rocks and more gently dipping, bedded pebbly wackes of the Coleman Member was intersected. The unconformity is quite sharp and dips at a steep angle to the east. The Huronian sedimentary rocks in this area dip approximately 12° to the east, decreasing to a dip of 4° away from the unconformity, which suggests that sediments may drape over a paleofault scarp. At the end of the crosscut, drifts were extended to the north and south along silver-bearing vein structures which discontinuously intersect the unconformity.

The south drift (4-3-S drift) follows a bearing of approximately 210° along the main 4-7 vein and extends for a distance of 680 feet. In this area, it is located 100 feet below the bottom Nipissing diabase sill contact. This vein has a length of 240 feet on this level and contains high-grade silver within the Keewatin mafic metavolcanic rocks. Four raises, totalling 220 feet, were put up through the 70°, east-dipping unconformity with Huronian sedimentary rocks. This vein structure represents a potentially mineable orebody and 350 tons of back have already been removed. In the same area, the 4-8 vein was intersected and appears to be a minor silver-arsenide structure which has yet to be tested. Plans for this area for 1990 include extensive fan drilling to test the surrounding area for new veins and to test for extensions below the known vein structures.

The north drift (4-3-N drift) follows a heading of 040° along the 4-3 vein which is in Huronian sedimentary rocks for much of its length. This vein appears to be an extension of the 4-7 vein, rather than a separate structure. It extends for a distance of 175 feet before being cut off by a subhorizontal fault system. A 30-foot high raise, and a short, south-trending subdrift have been used to explore this potentially mineable vein to date. At the end of the vein, the bearing of the crosscut veers to 325° and intersects two more veins. Both of these veins carry erratic high-grade silver values. Vein 4-5 trends at 100° and will be drill-tested in 1990, whereas vein 4-4 trends at 015° and has been tested with two raises totalling 60 feet to date. The 4-5 crosscut continues from this point at a bearing of 270° and intersects the 4-9 and 4-10 vein systems. The 4-9 vein, trending at 070°, continues a short distance and has been tested with one 80-foot raise. The 4-10 vein has only been intersected by drilling and is within Nipissing diabase approximately 100 feet above the level. Plans for this area in 1990 include follow-up diamond drilling as well as minimal follow-up raising and drifting.

On the eighth level, exploration was restricted to 100 feet of crosscutting at a heading of 305°. A drill station was cut and a drilling program completed during the year. For 1990, the company plans to extend this crosscut to the northwest or southwest and intersect the unconformity approximately 1 km to the west.

On October 27, 1989, the company continued to rationalize its area operations by laying off 50 percent of the Penna work force. Twelve people remain at the site. As part of the exploration program, 500 tons of development muck was mined and stockpiled on surface.

Upper Bonsall Mine (Sandy K Mines Limited–NLX Resources Inc.)

Derry, Mitchener, Booth, and Wahl, consultants to Sandy K Mines Limited, continued an underground exploration program, initiated the previous year, at the Upper Bonsall Mine near Gowganda. Past production from both the Upper Bonsall and Lower Bonsall mines totalled 256383 ounces of silver contained in 10114 tons of ore (Sergiades 1968). In 1987, Sandy K Mines Limited refurbished an existing adit, and in February 1988, completed 152.4 m of drifting, 33.5 m of raising and 6096 m of underground diamond drilling while investigating known areas of silver mineralization. In the spring of 1989, the company completed 3353 m of underground drilling in an attempt to intersect extensions of the Millerett No. 1 and No. 7 silver veins, south and east of previously mined stopes. One hole intersected 485 ounces silver per ton over 0.76 m on the No. 7 vein, which is located 61 m west and 24 m below the 135-foot adit level. The east-dipping structure consists of a 9 to 12 m wide zone of calcite veins containing silver, cobalt-arsenides and bismuth. NLX Resources Inc. has spent $2.68 million to date on the Sandy K Mines Limited property to earn a 20 percent interest. Exploration on the property was terminated at the end of February 1989 and is not expected to resume while silver prices remain depressed.

Leroy Shaft (Agnico-Eagle Mines Limited)

This property was acquired in 1988 and is located in Nicol and Haultain townships, near Gowganda. A dewatering program, initiated in late 1988, was completed in early 1989. The shaft was rehabilitated, the hoist brought up to Ministry standards, and the headframe stiff-legs and ore bin rebuilt. Also, trailers from the Castle Mine were trucked in to serve as office and dry buildings. A new 1.2 km road and a power line were constructed from the highway to the site of a proposed decline.

The shaft was dewatered to the 650-foot level, and all accessible levels remapped. Minor development and extensive underground diamond drilling were initiated. On the fifth level, the station was slashed (5 tons waste); and on the sixth level, the 6-03W crosscut was extended 195 feet (1894 tons waste), the 6-02S drift was slashed (568 tons waste) and the station was slashed (347 tons waste). This phase of exploration was stopped on May 5, 1989, although diamond drilling continued to mid-November 1989. At this time, exploration was terminated and the pumps were pulled, allowing the workings to flood. Underground diamond drilling for the year totalled 2107 m.

The area is underlain by Keewatin-age intermediate to mafic metavolcanic rocks intruded by Matachewan diabase dikes and a Nipissing diabase sill. The original shaft reached the 650-foot level in 1927, and extensive lateral work was completed on a series of calcite veins hosting native silver, nickel, cobalt-arsenides, pyrite and chalcopyrite. No high-grade ore zones were encountered at that time, and the best values were obtained from the No. 1 vein on the 488-foot level. Little or no production was reported. The geological setting is similar to the Castle Mine, with the entire Nipissing diabase sill preserved between metavolcanic rocks at surface and below the sill (McIlwaine 1970).

Kanichee Mine (Northern Platinum Ltd.–Northern Management and Consultants Limited)

Late in 1988, Northern Platinum Ltd. completed a four-year exploration program at the Kanichee Mine in Strathy Township. Stripping, trenching, diamond drilling and sampling identified a minor extension of the copper, nickel and platinum group-bearing Ajax ultramafic intrusion.

In 1989, the company focussed its efforts on the rehabilitation of the 500 ton per day concentrator plant and other mine facilities. A 4.5 mesh cone-crusher was installed, as were new electric motors. Ontario Hydro upgraded the power transmission line into the property and the 26 m deep open pit was dewatered and scaled. Approximately 10000 t of broken ore were hauled from the floor of the pit and stockpiled near the mill. A trial ten-ton bulk sample was subsequently obtained and milling and metallurgical tests completed at Lakefield Research. Some problems were encountered with water supply as the 450 gallon per minute plant could only obtain a 75 gallon per minute source of water. The original water line was removed for scrap several years ago. In addition, the Ontario Ministry of Natural Resources ordered the removal of two bridges spanning causeways along the mine access road for safety reasons. As a result, development has been temporarily suspended.

EXPLORATION ACTIVITY

Exploration activity continued in the decline that began in the middle of 1988, due in part to a combination of low gold and silver prices, lack of investor enthusiasm and confidence in junior mining ventures, and the continued restriction on claim staking as a result of the Bear Island Indian Land Claim. Total underground and surface diamond drilling decreased in 1989 by 38 percent to 35228 m, with surface drilling alone decreasing by 28 percent to 19965 m. It is now at a level similar to pre-flow-through days. Underground drilling declined by 47 percent to 15263 m, again reflecting the suspension of many flow-through funded exploration and development projects, and the exhaustion of silver mine reserves in producing mines. Claim staking activity remained fairly stable in relation to previous years and declined by only 6 percent. However, the number of claims cancelled also declined by 21 percent and resulted in a net gain in lands held for exploration.

Some positive events during the year included the implementation of the new Canadian Exploration Incentive Program (CEIP) by the Federal government, the legislation and introduction of the new Ontario Mineral Incentives Program (OMIP), and the implementation of the Ontario Prospector's Assistance Program (OPAP). These programs are intended to assist and promote ex-

TABLE 14.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Agnico-Eagle Mines Limited	Diamond drilling, Nicol and Haultain Townships
2	Agnico-Eagle Mines Limited	Geophysical survey, diamond drilling, Coleman Township
3	Armsher Resources Incorporated	Diamond drilling, property report, Bucke and Coleman Townships
4	Asquith Resources Incorporated (Buckingham Property)	Diamond drilling, Asquith Township
5	Asquith Resources Incorporated (Gosselin South Property)	Geophysical survey, stripping, Churchill Township
6	Asquith Resources Incorporated (Matona Property)	Diamond drilling, Tyrrell Township
7	Bishop, B.A.	Geophysical survey, Lorrain Township
8	Chesbar Resources Incorporated	Geological mapping, sampling, Macmurchy Township
9	Denison Mines Limited (R. Benner's McLaren Lake Property)	Diamond drilling, Firstbrook Township
10	Falconbridge Limited	Prospecting, linecutting, geological mapping, Kemp and Mond Townships
11	Falconbridge Limited	Diamond drilling, Burnaby Township
12	Gold Fields Canadian Mining Limited	Diamond drilling, Bryce Township
13	Gossan Resources Limited	Linecutting, geophysical surveys, Bryce Township
14	Greater Temagami Mines Limited	Core logging and re-evaluation, Phyllis Township
15	Gunter, C.	Stripping and trenching, Asquith and Churchill Townships
16	Highrock Contracting Limited	Stripping, trenching, sampling, geochemical survey, linecutting, geophysical survey, Bryce Township
17	Inco Limited	Linecutting, geological mapping, geophysical surveys, lithogeochemical sampling, Churchill Township
18	Janveaux, J.-M.	Stripping, trenching, sampling, Mattawan Township
19	Nealand Mining and Exploration Limited	Diamond drilling, trenching, stripping, Churchill Township
20	NLX Resources Incorporated	Diamond drilling, Haultain Township
21	Quote Resources Incorporated	Geophysical survey, linecutting, Firstbrook Township
22	Skead Holdings Limited	Geophysical surveys, Churchill and Kelvin Townships
23	Stroud Resources Limited and Corona Corporation	Diamond drilling, Strathy Township

TABLE 14.1. CONTINUED.

Number on Figure	Individual or Company	Activity
24	Teck Explorations Limited	Geophysical surveys and diamond drilling, Asquith Township
25	Unocal Canada Limited	Linecutting, stripping, geological mapping, trenching, geophysical surveys, diamond drilling, Churchill Township
26	858277 Ontario Limited	Trenching, sampling, diamond drilling, Bryce Township

ploration at all levels and may help offset further declines in the local mining industry.

Although the majority of surface exploration focussed on gold, the bulk of development and underground exploration was concentrated on silver. Interest was also evident in exploration for copper, nickel, platinum and various industrial minerals. These include metallurgical limestone and dolomite, feldspar, building stone, kyanite and vermiculite. Companies, other than those described in the following sections, which expressed an interest in the Cobalt Resident Geologist's District over the year included: A.C.A. Howe International Limited, Addsun Resources Limited, Bay Lake Explorations, Cold Stream Concrete Limited, Cominco Ltd., Corporation of the Town of Cobalt, Corporation of the Township of Coleman, Doelcam Incorporated, Exploration Services Limited, Faustex Limited, FinNeth Exploration Inc., Forano, Golder Associates, International Platinum Corp., Kasner Group, Lac Minerals Ltd., Lashex Limited, Madeleine Mines Ltd., Manridge Explorations Limited, Manville Canada, Noranda Exploration Company, Limited, Ontario Hydro, Rosscorp International Metals Limited, Silverside Resources Inc., Strike Minerals Inc., The Oscar Giroux Resources Limited and United Keno Hill Mines Limited.

A more complete summary of exploration activity in the Cobalt Resident Geologist's area in 1989 is provided in the following sections, Table 14.1 and Figures 14.1a, 14.1b and 14.1c. Relevant Ontario Geological Survey and Geological Survey of Canada publications are listed in Table 14.2.

COBALT AREA

Armsher Resources Ltd. completed 1676 m of diamond drilling in five holes on a silver property in Coleman and Bucke townships. The holes intersected relatively narrow, and predominantly barren, calcite veins which cut Gowganda Formation Coleman Member conglomerate. Parts of the conglomeratic beds were heavily mineralized with copper, lead and zinc minerals. Only minor, anomalous silver values were obtained.

Agnico-Eagle Mines Limited completed a deep-pulse University of Toronto electromagnetic (UTEM) geophysical survey on claims in Coleman Township and confirmed the presence of numerous conductors identified in an earlier Ontario Geological Survey research project (Hanneson and Huxter 1989; Hanneson et al. 1989). This survey was followed up with 589 m of diamond drilling in four holes on one of these conductors. The holes intersected the unconformity at a relatively shallow depth and revealed the presence of Keewatin felsic metavolcanic rocks carrying disseminated pyrrhotite-chalcopyrite mineralization, interbanded with two varieties of interflow metasedimentary rocks.

B.A. Bishop completed a ground magnetic and a very low frequency electromagnetic (VLF-EM) survey on a single silver claim located in Lorrain Township. A grid, consisting of 1.7 line-kilometres, was cut with lines turned at 122 m intervals. An attempt was made to identify the presence of possible conductive zones near a Nipissing diabase–Huronian sedimentary rock contact which might host silver- and cobalt-arsenide-bearing structures. A single conductor was located, but no further work was undertaken. The property hosts the old Caswell Mine which yielded 1503 ounces of silver and 4932 pounds of cobalt *circa* 1936 (Sergiades 1968).

Quote Resources Inc. completed line cutting and ground geophysical surveys on a ten-claim property in Firstbrook Township. This work was part of a follow-up program related to a Canada–Ontario Mineral Development Agreement (COMDA)-funded deep-pulse electromagnetic geophysical survey completed last year by the Ontario Geological Survey.

R. Benner and Denison Mines Limited completed 1610 m of diamond drilling in two holes on a silver property in Firstbrook Township. Both holes intersected a fairly consistent sequence of extremely silicified Keewatin metabasalts interbanded with cherts and tuffaceous sedimentary rocks. A number of significant fault structures were also encountered. Small, euhedral pyrite crystals were common throughout the section, and disseminated pyrrhotite-chalcopyrite mineralization occurred over significant widths in both silicified metabasalts and cherts. The first hole was terminated after intersecting a series of lamprophyre dikes.

ENGLEHART AREA

Exploration activity in this area, particularly in Bryce Township, remained at a relatively high level as in 1988, reflecting a strong interest in gold potential. At least four companies carried out significant exploration projects while numerous prospectors were active in the area. The focus of interest centres on auriferous, carbonatized shear zones hosted in Archean intermediate to mafic metavolcanic rocks.

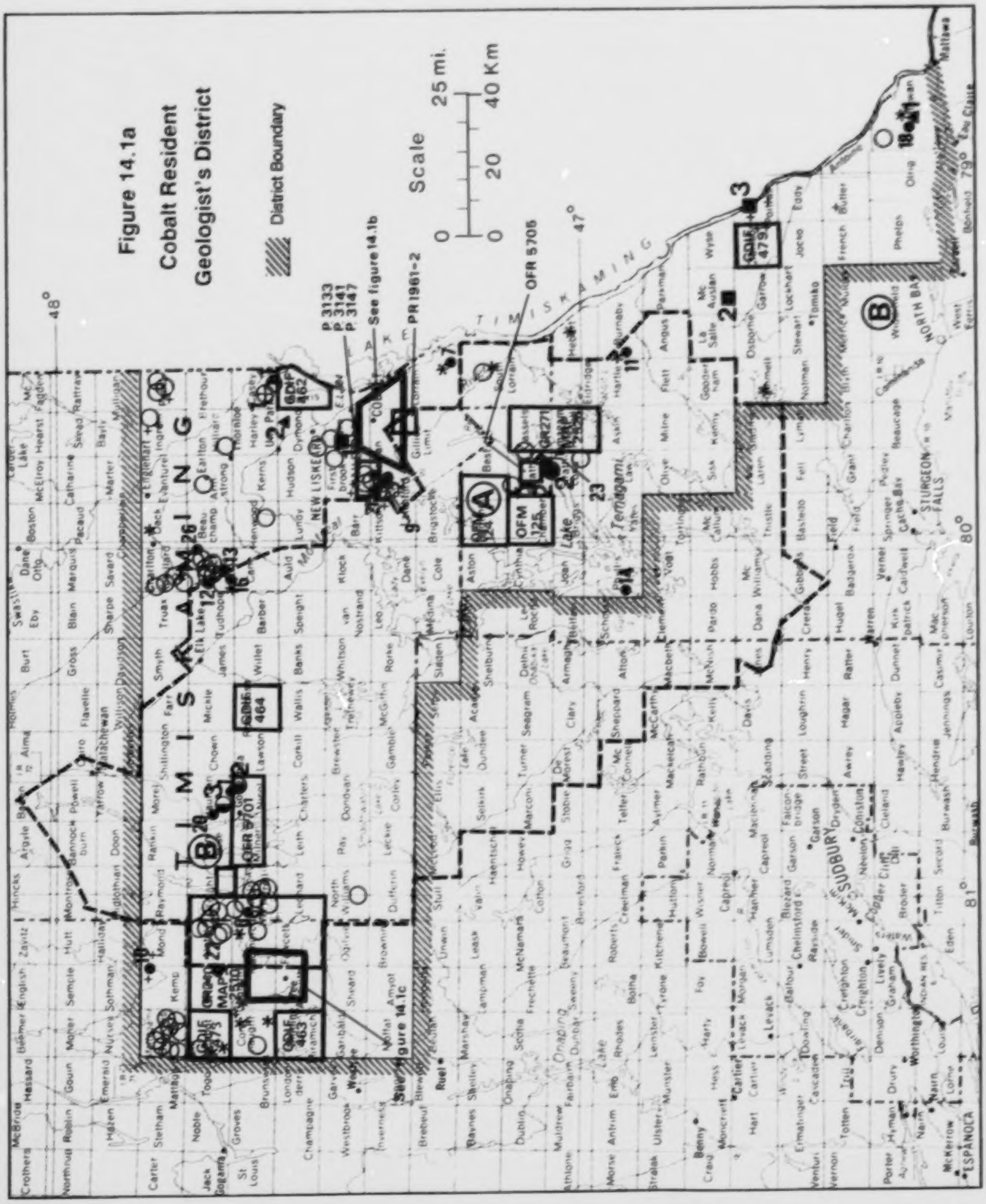

District Boundary
Scale
0 25 mi.
0 20 40 Km
48°
47°
81°
80°
79°
T I M I S K A M I N G
L A K E
T I M I S K A M I N G
NEW LISKEARD
See figure 14.1b
See figure 14.1c
P 3133
P 3141
P 3147
PR1961-2
OFR 5705
OFR 5701
OFM 125
GDIF 462
GDIF 464
GDIF 463
GDIF 479
A
B
Temagami
Lake
SUDBURY
NORTH BAY
STURGEON FALLS
ESPANOLA
Mattawa

Figure 14.1a

Cobalt Resident Geologist's District

EXPLANATION

● Producing Mines, 1989
   1. Beaver-Temiskaming Mine (Agnico-Eagle Mines Ltd. . . . . Ag
   2. Sherman Mine (Dofasco Inc. and Tetapaga Mining Co. Ltd.) . . . . Fe

◑ Mines Under Development, 1989
   1. Penna Mine (Agnico-Eagle Mines Ltd.) . . . . . . Ag
   2. Kanichee Mine (Northern Platinum Ltd./Northern Management and Consultants Ltd.) . . . . Cu, Ni

◐ Mines Undergoing Exploration, 1989
   1. Conisil Mine (Agnico-Eagle Mines Ltd.) . . . . . . Ag
   2. Leroy Shaft (Agnico-Eagle Mines Ltd.) . . . . Ag
   3. Upper Bonsall Mine (Sandy K Mines Ltd./NLX Resources Inc.) . . . . Ag

▲ Properties Under Evaluation, 1989
   1. Janveaux, J.-M. . . . . feldspar
   2. Breault Quarry (Dymond Clay Products Ltd.) . . . . limestone

⊕ Mines Currently Maintained on Stand-by Basis
   1. Langis Mine (Agnico-Eagle Mines Ltd.) . . . . . . Ag

■ Producing Quarries
   1. Bucke Quarry (Dymond Clay Products Ltd.) . . . . limestone
   2. McLaren's Bay Mica Stone Quarries (G. Boughner) . . . . stone
   3. Thorne Brilliant Stone Quarry (P. Pharand) . . stone

⦶ Operating Mills
   1. Penn Mill (Agnico-Eagle Mines Ltd.)

◬ Operating Refineries
   1. Agnico-Eagle Silver Refinery (Agnico-Eagle Mines Ltd.)
   2. Cobalt Refinery (Cobalt Refinery Ltd.)

● Exploration Activity in 1989 (keyed to Table 14.2)

✦ Claim Staking Activity in 1989

✱ Assessment Work Filed in 1989

○ Core Stored in Cobalt Drill Core Library

Ⓐ Location of Resident Geologist's Field Mapping Parties in 1989

Ⓑ Location of Ontario Geological Survey Field Mapping Parties in 1989

━━ Map, Report or Open File Issued by the Ontario Geological Survey in 1989

— — Areas Withdrawn from staking through the Bear Island Indian Caution

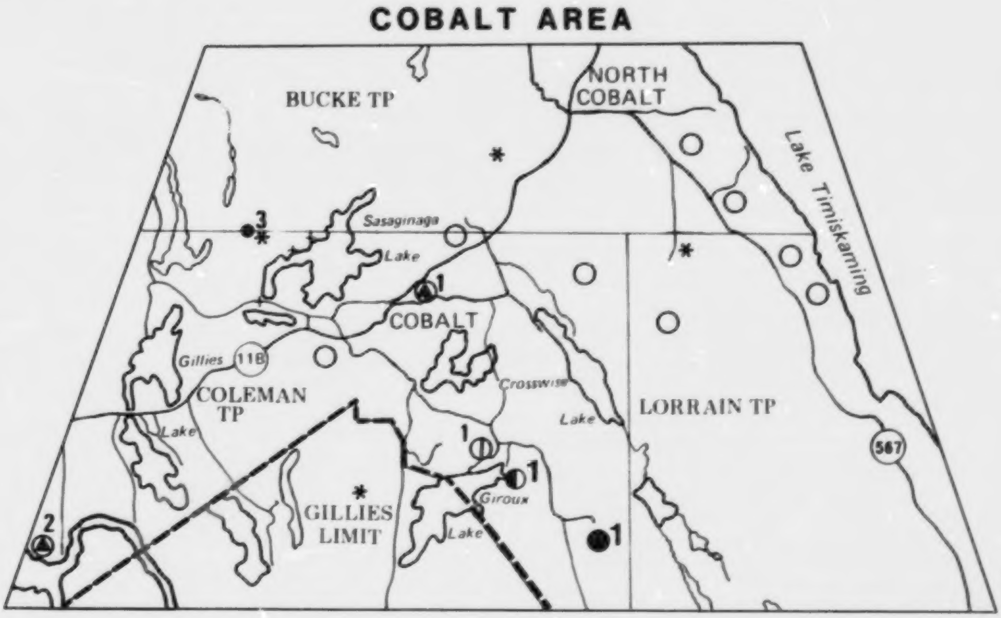

COBALT AREA
BUCKE TP
NORTH COBALT
Lake Timiskaming
Sasaginaga Lake
3
1
COBALT
Gillies Lake
11B
COLEMAN TP
Crosswise Lake
LORRAIN TP
567
1
1
GILLIES LIMIT
Giroux Lake
1
2

Figure 14.1b. Cobalt Resident Geologist's District. For legend, see Figure 14.1a.

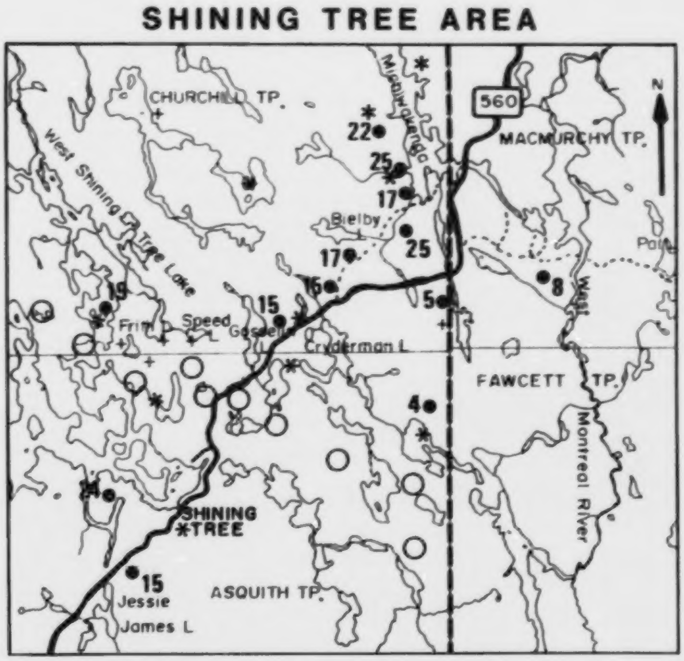

SHINING TREE AREA
CHURCHILL TP.
560
MACMURCHY TP.
N
West Shining Tree Lake
22
25
17
Bielby L.
25
17
16
15
19
Frith
Speed L.
Cryderman L.
5
8
West
FAWCETT TP.
4
Montreal River
14
SHINING TREE
15
Jessie James L
ASQUITH TP.

Figure 14.1c. Cobalt Resident Geologist's District. For legend, see Figure 14.1a.

TABLE 14.2. MAPS AND REPORTS PERTAINING TO THE COBALT RESIDENT GEOLOGIST'S DISTRICT PUBLISHED DURING THIS YEAR BY THE ONTARIO GEOLOGICAL SURVEY, MINISTRY OF NORTHERN DEVELOPMENT AND MINES.

Ontario Geological Survey Reports
PR1961-2 (Reprint)
Report 240
Report 271

Open File Reports
OFR 5701
OFR 5705

Open File Maps
OFM 124
OFM 125

Preliminary Maps - Geological Series
P. 3133
P. 3141
P. 3147

Geological Data Inventory Folios
GDIF 462
GDIF 463
GDIF 464
GDIF 478
GDIF 479

Coloured Maps
2510
2526

Mineral Development and Lands Branch Publications

Miscellaneous Reports
MP 77 Supplement
MP 139 (Reprint)
MP 140
MP 141
MP 142
MP 143
MP 146

Mineral Deposit Circulars
MDC 27 (Reprint)

Mineral Resource Circulars
MRC 12 (Reprint)

Geological Survey of Canada Publications
OFR 1956

Gold Fields Canadian Mining Limited completed a five-hole, 2862 m diamond-drilling program in late 1989 on the Petromet Resources Limited Briscoe–Bryce property in central Bryce Township. The property was the site of a major trenching program completed along an auriferous and sulphide-rich, sericitized quartz-carbonate vein system in 1987 and 1988 by Kapalua Gold Mines Ltd. (Owsiacki, Cosec and Anderson 1989). The current exploration failed to intersect significant down-dip extensions of the vein system (W. Waychison, Gold Fields Canadian Mining Limited, personal communication, 1989).

An exploration program was carried out on four patented claims and three staked claims in northeastern Bryce Township by 858277 Ontario Ltd. in late 1989. The claim group includes the former B. Holmes property (Whitton prospect), on which three shafts were sunk prior to 1940 (Moorhouse 1944). The claims are underlain by massive, medium-grained, mafic metavolcanic rocks which are, in part, unconformably overlain by a thin veneer of Gowganda Coleman Member conglomerate. The major structure appears to be a northeast-trending shear zone on which both past and present exploration has been carried out. Recent trenching on claim T19434 resulted in the discovery of the westerly extension of a sulphide-bearing quartz-carbonate vein near the No. 1 shaft. The vein is up to 0.3 m wide, strikes at 225° and dips 75°N. Both a gossan zone and minor shearing occur in the hanging wall but are absent on the footwall side of the vein. Two beds of cherty iron formation, up to 0.1 m wide, occur adjacent and parallel to the vein. On a separate occurrence, sheared and carbonatized mafic metavolcanic rocks were exposed during stripping operations near the No. 2 shaft on claim T23279. A fine-grained quartz vein, with a maximum thickness of 0.3 m, is located on the west wall of the shaft. The vein strikes 060° and dips 065°S. Grab samples of the vein contained minor amounts of pyrite, chalcopyrite, magnetite, arsenopyrite and malachite. Muck from the bottom of the shaft contained similar mineralization as well as brecciated, cherty iron formation. According to A. LaCarte (Prospector, personal communication, 1989), samples of this material assayed 1.31 ounces gold per ton. The company is presently drilling in this area to test for extensions of both vein systems. This drilling should be completed by the end of January 1990.

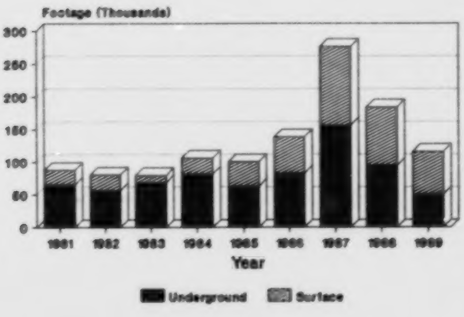


Figure 14.2. Exploration diamond-drilling activity in the Cobalt Resident Geologist's District.

Gossan Resources Ltd. resumed exploration started four years ago on a 1280 acre claim group in central Bryce Township. The most recent activity included 64 km of line cutting which was followed up with magnetic and VLF-EM geophysical surveys. The property, known as the Libby prospect, hosts 16 gold and copper showings and includes the Borgford gold occurrence, one of the earliest discoveries in the area. The predominant host rocks are Archean intermediate to felsic tuffaceous metavolcanic rocks which are overlain in the southeastern portion of the claims by a veneer of Coleman member conglomerate of the Gowganda Formation. Within the Archean rocks, shearing and alteration are localized along northwest-trending faults. These areas, together with alteration zones associated with small porphyritic intrusive bodies, are the principle sites of precious metal mineralization (Moorhouse 1944).

Highrock Contracting Limited continued to work on claims located in the southwestern part of Bryce Township and expanded their holdings from 11 to 14 claims. During the year, the company completed limited line cutting and VLF-EM and magnetic geophysical surveys in the vicinity of previously identified surface gold showings. Following this phase of exploration, trenching of 16 shallow pits was completed along the length of a conductor whose surface expression was characterized by the presence of pyrite, malachite and magnetite within sheared intermediate metavolcanic Archean rocks. Gold values up to 0.229 ounce gold per ton were obtained from this zone (G. Dunn, Highrock Contracting Limited, personal communication, 1989). The company plans to continue exploration in 1990.

SHINING TREE AREA

Exploration in the Shining Tree area continued at a moderately active pace in 1989, with most companies carrying out geophysical surveys and diamond drilling. Activity was concentrated on gold exploration, predominantly in southeastern Churchill and northeastern Asquith townships. Staking activity was heavy in Connaught and Churchill townships, particularly in September when a large claim block, formerly held by Onitap Resources Inc., came open for staking. Exploration in Tyrrell Township and those areas east of Shining Tree was minimal and restricted to leased properties, primarily because of the influence of the Bear Island Indian Land Caution. Some negative developments during the year included the curtailing of surface and underground exploration and development at the Tyranex Gold Inc.-Gunnar Gold Mining Corp. Tyranite Mine in Tyrrell and Knight townships. Anticipated exploration and development projects also failed to materialize at the Duncan Gold Resources Inc. open pit gold property in Tyrrell Township.

Asquith Resources Inc. completed a 2438 m diamond-drilling program at the Matona gold property in Tyrrell Township. Carter (1977) stated that this occurrence is hosted within felsic metavolcanic rocks in the upper part of a volcanic sequence. The main occurrence on this property was previously explored with a two-compartment shaft which was sunk in 1936 on a 30 m wide by 180 m long shear zone. The shear zone contained quartz, carbonates, pyrite and visible gold mineralization. Two levels were established at depths of 125 and 213 feet, but development was suspended in 1937. Subsequent diamond drilling defined reserves of 30000 tons, grading 0.385 ounce gold per ton (Assessment Files, Cobalt Resident Geologist's office). The current drilling program was not encouraging and the company's option on the property was dropped.

Subsequently, Asquith Resources Inc. initiated exploration on its 72-claim Buckingham property in Asquith Township. Twenty-one diamond-drill holes, totalling 3048 m, were completed in 1989. The best reported intersection was 0.5 ounce gold per ton over a 2.7 m interval. Visible gold was also reported from core in seven other holes. The best values were obtained from a series of parallel, quartz-filled shear zones within carbonatized mafic metavolcanic rocks. The company plans to complete $250000 of additional exploration on this property in the future (The Northern Miner, August 21, 1989). A ground VLF-EM survey and minor stripping were also completed on the single-claim Gosselin South property in Churchill Township. Exploration failed to identify any potential for precious metal mineralization at this location.

Chesbar Resources Inc. completed geological mapping and sampling of the Tut gold property in Macmurchy Township (Chesbar Resources Inc. 1989). The claims include the Caswell and Westree properties, on which several shafts were sunk on a series of gold-bearing quartz veins within carbonatized mafic metavolcanic rocks in the late 1930s. The most recent work was a follow-up to diamond drilling completed early in 1988.

Nealand Mining and Exploration Limited carried out trenching and stripping on a gold property located on the shores of West Sining Tree Lake in Churchill Township. Gold occurrences in this area are normally found within pyritiferous, quartz-carbonate stringer veins hosted in interbedded mafic and felsic metavolcanic flow rocks (Carter 1980). The company completed a 122 m diamond-drill hole on the property during the winter of 1988–1989.

Unocal Canada Limited completed line cutting, stripping, trenching, geological mapping, ground geophysical surveys and approximately 1524 m of diamond drilling on the gold property of Strike Minerals Incorporated in southeast Churchill Township (J. Parres, Strike Minerals Incorporated, personal communications, 1989). Stripping by the company exposed a heavily carbonatized zone within mafic metavolcanic rocks, immediately south-southwest of, and on strike with, the auriferous Pet quartz vein. Brecciated and interbanded oxide-facies iron formation occur within, and peripheral to, the alteration zone. Grab samples obtained during field visits by staff of the Cobalt Resident Geologist's office, and assayed at the Temiskaming Testing Laboratory in Cobalt, carried no significant amounts of gold or silver. Channel sampling was undertaken by the company, but results of this work and from diamond-drill core were not available at the time of writing.

C. Gunter completed minor stripping and trenching on the Mossan gold occurrence in Asquith Township, and on claims near Beilby Lake in Churchill Township. Work on the latter claims was undertaken in an attempt to locate western surface extensions of the nearby gold-bearing Pet and Gold Corona quartz veins.

Inco Limited completed a program of line cutting, geological mapping, ground magnetic and VLF-EM geophysical surveys, and lithogeochemical rock sampling on two claims in Churchill Township. The property lies immediately west and north of the Gold Corona and Kingsley gold occurrences.

Teck Explorations Limited drilled a single 32 m diamond-drill hole on the West Shining Tree Lake property in Asquith Township. This work follows ground VLF-EM and magnetic geophysical surveys. The hole intersected sericitized and carbonatized mafic metavolcanic rocks hosting minor, narrow quartz veins with up to two percent disseminated pyrite.

Falconbridge Limited initiated exploration on a large claim group located in northern Kemp and Mond townships. Extensive sand overburden in the area may be underlain by bodies of peridotite, dunite and serpentinites that intrude felsic metavolcanic rocks. These intrusions may prove to be favourable sites for base metal and platinum group element (PGE) mineralization.

Skead Holdings Limited completed airborne VLF-EM and magnetic surveys over a number of claim blocks in northern Churchill Township and southern Kelvin Township. Several interesting anomalies were identified and, in the near future, the company may proceed with geological mapping and ground geophysical follow-up surveys, comprising both vertical gradient magnetic and horizontal-loop electromagnetic (HLEM) surveys.

GOWGANDA-ELK LAKE AREA

Agnico-Eagle Mines Limted completed approximately 1219 m of diamond drilling at their Leroy Lake property in Nicol and Haultain townships. This work was carried out as a test for potential silver mineralizaton to follow up previous geological mapping, geochemical sampling and diamond drilling. The drilling was still underway at the time of writing (D. Marek, Agnico-Eagle Mines Limited, personal communicaton, 1989) and, to date, has identified a few interesting silver intersections along possible extensions of previously known structures.

NLX Resources Inc. contracted Derry, Mitchener, Booth, and Wahl Limited to carry out 762 m of diamond drilling at the Sandy K Mines Limited Bonsall Mine property in Haultain Township. The surface drilling program was intended to intersect extensions of the Millerett No. 1 and No. 7 silver- and cobalt-arsenide-bearing calcite veins, which were otherwise inaccessible from the underground workings.

TEMAGAMI AREA

Depressed precious metal prices, and the continued ban on claim staking resulting from the Bear Island Indian Land Caution, effectively stifled activity in the Temagami area during 1989.

In early 1989, Stroud Resources Limited and Corona Corporation completed a 3109 m diamond-drilling program on the Leckie gold prospect (formerly the Penrose Mine) in Strathy Township. In an effort to increase gold reserves, these and other companies have carried out drilling over the past three years on this property (Owsiacki, Cosec and Anderson 1989). The latest exploration drilling has exposed the mineralized length of the Main Zone to 305 m, down to a depth of 305 m. Assays from this drilling included 0.126 ounce gold per ton over a width of 6 m, which included a section assaying 0.224 ounce gold per ton over 2 m. The objective of any future drilling will be to expand reserves at the Main Zone, and continue exploration of a second gold occurrence location southwest of the Main Zone (Stroud Resources Limited 1989).

Greater Temagami Mines Limited maintained a part-time work crew at their Temagami copper Mine site reorganizing and relabelling core boxes as well as carrying out routine repairs on the remaining buildings.

NORTH BAY AREA

Exploration activity in this area declined moderately in 1989, and followed the trend established over the rest of the Cobalt Resident Geologist's District. In addition to building stone, gold, base metals, diamonds and feldspar, a variety of other industrial minerals including vermiculite, muscovite and kyanite were prospecting targets.

Falconbridge Limited completed a diamond-drilling program on claims located in Burnaby Township in an effort to test a magnetic anomaly prevoiusly outlined by airborne and ground geophysical surveys (Owsiacki, Cosec and Anderson 1989). Disseminated bands of very fine grained magnetite were intersected within host monzonitic gneisses and may represent metamorphosed iron formation. Exploration in this area and in others south of the Grenville Front has been focussed on base metal potential, together with possible gold and platinum potential associated with intrusive gabbros. The area is also cut by major northwest-trending faults which host kimberlite dikes sporadically along their length.

J.-M. Janveaux stripped and trenched several outcrop areas in Mattawan Township, near Kearney Lake. This work exposed a series of northeast-trending, albite-quartz-biotite pegmatite dikes within biotite-hornblende-garnet schist. The dikes are relatively narrow (less than 2 m) and steeply dipping. Property visits to the site revealed a small feldspar hand-cobbing operation. Tests are presently being completed to assess impurity contents in the material. J.-M. Janveaux is interested in the feldspar for its potential applications in the high-temperature ceramics industry. Feldspar has not been produced commercially from this area since the late 1940s.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

During the year, the Cobalt office was staffed by Resident Geologist, L. Owsiacki; Staff Geologist, M. Cosec; Secretary, K. Larabie; Contract Geologists, P. Anderson, E. Dodd, P. Born and D. Robinson; Cartographer,

L. Francis; Typist, R. Williston; Field Assistant, D. Bailey; and Experience '89 Student, B. Allinotte.

Despite the precipitous decline in exploration and development activity in the area during the year, office use by our clients declined only marginally (7 percent) from the record levels attained last year. Similarly, sales of publications declined by only 11 percent from record levels recorded last year. Numerous staff projects, all funded through non-base sources, continued throughout the year and will all be completed by the end of March 1990. However, with no additional funding expected, no new projects will be carried out and basic services will undoubtedly decline.

Along with regular duties, Staff Geologists prepared and completed a prospectors course which was extremely well received and attended; reviewed and commented on proposals for property severances, Municipal Zoning Plans, Northern Ontario Resources Transportation Committee (NORTC) mine road improvement requests, Ministry of Natural Resources Timber Management Plans, Ontario Hydro transmission route plans, Temagami area mineral potential and land use plans, and land withdrawal requests. In all cases, both mineral and hazard potential were identified and the information provided in both map and written form for input into these plans. Assistance was also provided to the Cobalt Northern Ontario Mining Museum in its maintenance of the Heritage Silver Trail (a mining tourist attraction). Use of the trail increased again, by approximately 7.9 percent compared to last year, as an estimated 7956 people took advantage of this attraction. This increase is considered significant for two reasons: a lack of brochures, advertising and promotion during the year, and a rise in tourism despite a general decline throughout the rest of northern Ontario in 1989. The office once again represented the MNDM at the Cobalt Miner's Festival which was held in early August. Staff participated on the planning committee and manned displays featuring area geology, mining history and area exploration.

Numerous field trips were provided during the year for a variety of organizations and individuals from the public and industry. Some of these trips included MNDM personnel from Sudbury and Toronto, students from the University of Michigan, Miners' Festival participants, the Cobalt Senior Citizens' Club, and students from École Sainte Croix. Field trips promoting area geology and mineral potential were also carried out for a number of representatives of mining companies interested in the area.

In addition, lectures were provided to the French Cub Pack from Haileybury at their "mining" camp and to students from several levels at New Liskeard Public School, École Sainte Croix in Haileybury and St. Patrick's School in Cobalt. Numerous presentations were also made by staff during the year. In February, poster displays illustrating area exploration and development activities were prepared and displayed at the Northeastern Region Geoscience Seminar in Timmins. In October, a Professional Development Day seminar was provided for teachers in the Timiskaming District to aid them in the development of geology and mining-related subjects in their classrooms. In November, a talk describing the geology of Banting and Best townships was presented to the Cobalt Branch of the Canadian Institute of Mining and Metallurgy. The same talk was later presented at the Ontario Mines and Minerals Symposium in Toronto. Three poster displays describing area projects were also prepared and displayed as part of this symposium.

Staff also attended a number of seminars and training sessions during the year. Some of these included Workplace Hazards Management Information System (WHMIS) training, Secretarial Seminar, Performance Management and Employment Equity seminars, MASS 11 training, the Prospector's and Developer's Association of Canada convention, Surface Crown Pillar Evaluation for Active and Abandoned Metal Mines seminar, Institute of Northern Ontario Research and Development (INORD) (academic perspectives on Temagami), and Temagami Comprehensive Planning Committee meetings.

The Staff Geologist and Contract Geologists visited over 40 active properties to provide assistance and act as liasons between individual prospectors and junior and major mining companies. In excess of 27 inactive properties were also visited to obtain additional data on mineralization and/or geology. These properties were visited a number of times over the course of the year. In addition, an underground sampling program of most remaining silver and cobalt veins at the Hellens–Eplett silver mine was completed prior to this mine's closure early in 1989.

The Resident Geologist was primarily occupied during the year with administration and management of numerous COMDA projects and base operations. Technical assistance and consulting services were also provided to prospectors, industry representatives, geologists, government and the general public as a means of encouraging and facilitating effective exploration and development in the area. Over the year, an increasing amount of time (now 70%) was spent in managing the office and staff and responding to office visitors and inquiries. The remainder of time was spent primarily attending meetings and acting on any one of a dozen committees and working groups. A handful of property visits and underground mine visits were completed together with three field trips held for explorationists.

In addition, the position of Acting Manager, Temiskaming Testing Laboratory was added to the regular full-time duties of the Resident Geologist. This resulted in much time initially being spent on familiarization with the facility and dealing with numerous inherited problems. In addition, a paper was presented in September in Timmins as part of the Canadian Mineral Analysts Conference describing bulk sampling procedures at the facility. During the fall, a concerted effort was made to find new clients and significant modifications were made to the processing system and laboratory in order to enhance processing capabilities.

As part of the new French Language Services Act, an extension course was started in the fall to assist in upgrading French-speaking capabilities.

Many projects initiated in the past few years were continued, and some are described in more detail in the following sections. These projects are aimed at expanding the local economic base, providing new data to assist in finding and developing new commodities, and expanding our knowledge of the geology and ore-forming processes in the camp.

HAZARD LANDS ABATEMENT PROGRAM

The Hazard Lands Abatement Program was initially implemented in Cobalt in 1987. It is funded by the MNDM, administered by the town of Cobalt and implemented by consultants; in this instance, Golder Associates Limited.

The program began with investigation, assessment and remedial work which followed the collapse of a stope under Highway 11B on June 22, 1987. Site investigation revealed that four areas had been mined to surface in the 1920s or 1930s, and little or no bedrock existed at these locations. Several other areas in Cobalt were suspected of being hazardous because of possible crown pillar removal or historic surface or near-surface stoping. A search of old records, interviews with former miners, air track and diamond drilling, auger hole boring, underground inspection, and radar, seismic and magnetic surveys were all utilized to more accurately identify potential problem areas. During these investigations, the terms of reference for the consultants were established "to investigate and develop remedial plans for rebuilding the road in the vicinity of the collapsed section of the highway right-of-way and to evaluate subsurface conditions along the remainder of the Highway 11B corridor through the Town" (Golder Associates Limited 1987e). Three phases or sites for investigation were initially outlined:

1. the site of the collapse about 100 m west of Galena Street
2. from the Townsite circle to Nickle Street
3. the remainder of the highway north through Cobalt

Following a thorough investigation, completed during the summer of 1987, work began to repair Highway 11B in the area of initial collapse. A reinforced concrete bridge deck, spanning a weak crown pillar was constructed and covered with overburden. The road was then paved, leaving a slight knoll as the only marker left to identify the site.

With the completion of the "pothole" reconstruction, Phase 2 began with a detailed site investigation of the nearby area, in the immediate vicinity of the Senior Citizens' Building. Diamond drilling and soil augering were utilized to determine rock conditions below and adjacent to the building. A ground-penetrating radar survey was subsequently carried out by A-Cubed Incorporated and used to identify locations of possible stopes and drifts. Three zones of concern were located and further drilling identified the presence of two potentially dangerous stopes near the building. Rock mass competence varied considerably (Golder Associates Limited 1988b). Simultaneously, interior and exterior visual inspections of nine homes and the Senior Citizens' Building were carried out by Morrison Hershield Limited (1987) to locate existing defects or deficiencies related to drilling or construction operations. Further investigations, to fully delineate the extent of stoping and the condition of the stopes, included a television and ultrasonic profiling of the shaft and stope area, down to water level. Access was gained through a six inch diameter well hole drilled in an existing concrete shaft cap. This survey suggested that the stope geometry was more complex than expected, but also revealed the rock mass to be more competent than previously thought (Golder Associates Limited 1988d).

In the final phase of inspection, the hole in the shaft cap was enlarged to allow a shaft cage to be lowered to afford direct observation of the stope to groundwater level. Following this inspection, a remotely operated submersible vehicle (Phantom 500), carrying an additional video camera to examine rock crowns; a 360° colour scanning sonar sonde to provide underwater profiles of openings; and an infrared Distomat for above water distance to crown measurements were utilized. The inspection, which took place on November 9, 1988, provided excellent details of conditions in the stope for a distance of up to 50 m from the shaft. The presence of clear water resulted in sharp pictures and also served as an indication that little or no groundwater movement, which might possibly erode infill material, was likely to occur. A decision was subsequently made to fill the stope, with provisions also made to fan drill and shotcrete the areas with complex stope geometry. A concrete plug was poured within the crown to ensure a tight fit and to increase the rock competence (Golder Associates Limited 1988f). Work was completed in the fall of 1989.

While this remedial work was taking place, Phase 3 of the highway investigation was started. An extensive search of old mining records, interviews with former miners, and a review of radar surveys completed earlier as part of a watermain project, revealed possible areas of concern. Locations of underground workings obtained from mine plans were found to confirm some of this information and to coincide in some locations with radar profiles. However, subsequent air track and diamond drilling determined that sufficient bedrock remained to ensure the safety of the areas. No near-surface unrecorded stopes were found during this survey (Golder Associates Limited 1988c).

As a result of a separate, earlier survey, a potentially hazardous situation was identified at the Cobalt Public School. In August 1988, drilling confirmed the existence of two stopes in the immediate vicinity of the school. A borehole television camera and ultrasonic survey provided details of the stope geometry and rock conditions. It was found that the crown pillar geometry of the vein No. 16 stope was relatively thin in the vicinity of the boiler room and the west side of the school, which is located adjacent to an old shaft. The remaining crown pillar over the two stopes was judged to be of adequate thickness and the stope walls appeared competent (Golder Associates Limited 1988e). Although there was no significant structural distress apparent in the building itself, it was deemed advisable to backfill to the stope crown to prevent future problems. Sand was blown in to fill the stope as tightly as possible and a concrete cap was placed in the gap between the crown pillar and the sand to improve the rock mass conditions. Work was completed in the summer of 1989.

On March 28, 1989, a public forum was held to explain the work that was being undertaken and to obtain information regarding locations of any unknown additional hazards. Several areas were suggested and follow-up investigations are currently in progress. At 76 Silver Street, the site of an earlier stope collapse (September 1988), further drilling was required to investigate the possibility of the presence of another previously unknown stope. Although the results were inconclusive, it was decided that the close proximity of mine workings to the house was unacceptable and that the house should be purchased, demolished and the area fenced.

An investigation of potential hazards under the Ontario Northland Transportation Commission (ONTC) railway right-of-way through the town was also completed by Trow and Associates Limited in November 1988. This preliminary study included interviews with local citizens and a thorough mining records search. The confidential report was submitted to the ONTC and no further action has been taken.

MISCELLANEOUS HAZARDS

Hunters and fishermen reported several dangerous mine openings to office staff during the fall. Those sites which can be reached by road, all-terrain vehicle or snowmobile, will be inspected in the spring and temporary fencing installed where the hazard is deemed to be of immediate danger. Many of these sites are known abandoned mines located on dormant, patented claims for which no funds are available for remedial work. Two sites deemed very hazardous and brought to the attention of this office were inspected and protected with construction fencing in 1989. Reports are usually submitted to the Ontario Ministry of Labour and Ministry of Natural Resources for their use in rectifying some of these potentially dangerous hazards.

In March 1989, a pit or shallow shaft of unknown depth, located 3 m from a well-used snowmobile club trail and approximately 30 m from a popular tobaggan run, was reported to the office by children in North Cobalt. This site was temporarily protected with construction fencing. During the summer, several unsuccessful attempts were made by the owners to fill the pit. The temporary fencing was subsequently reinstalled pending further action.

In August 1989, an open shaft at the Nipissing Lorrain Mine in South Lorrain Township was reported. The shaft is 116 m deep and is easily accessed from a road near the entrance to the Maiden's Bay Camp, located approximately 100 m away. Construction fencing was erected to mark the hazard. The portal of an adjacent adit was previously safeguarded.

RESEARCH BY RESIDENT OFFICE STAFF

GEOLOGY AND MINERAL POTENTIAL OF BANTING TOWNSHIP AND THE WESTERN PART OF BEST TOWNSHIP

Detailed mapping and sampling of Banting Township and the western part of Best Township was completed in 1989 at a scale of 1:7920. The geological map was recently displayed as an open file map at a scale of 1:20000 (Owsiacki, Smyk and Born 1989), and the final coloured map will be published in 1990. This project represents an extension of earlier investigations of a narrow metavolcanic inlier by Owsiacki (1983, 1984), and Smyk and Owsiacki (1986). The project is funded by the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, and encompasses an area of approximately 110 km² near Temagami, Ontario.

Archean metavolcanic rocks are the oldest rocks in the area and are, for the most part, confined to a single, branching belt located in the central portion of the study area. Narrow extensions of this belt and other smaller, discrete volcanic units are exposed in both the southeast and southwest parts of the area. Many of these isolated zones occur within a granitic batholith and the original structures and textures have been destroyed by assimilation, making the identification of the unaltered protolith difficult. These metavolcanics typically contain chlorite, amphibole and biotite, and have undergone greenschist- to amphibolite-facies contact and regional metamorphism. They are commmonly incorporated within a granite migmatite which is developed locally. In the main volcanic belt, the rocks predominantly consist of tholeiitic mafic flows overlain by calc-alkalic pyroclastic rocks. Of particular note are distinct and mappable mega-feldspar-phyric flows of tholeiitic affinity at the base of the sequence.

These metavolcanic rocks have been intruded by an Archean hornblende gabbro-diorite complex, granites, lamprophyre and diabase dikes, and a diatreme-igneous breccia complex.

A mafic to ultramafic body intrudes the metavolcanic rocks along the southern margin of the volcanic belt with younger Archean granitic rocks. The unit more closely resembles a hornblende gabbro and is characterized by a variable coarse-grained texture, distinct mottled appearance, and well-developed foliation. In some places it contains up to 25 percent disseminated magnetite. The amount of alteration and deformation within the gabbro is apparently less intense than the adjacent metavolcanic rocks. Agmatitic textures are commonly developed in some areas. Angular blocks, with sharp boundaries of coarse-grained hornblende gabbro and fine-grained hornblendite, are both rafted and intruded by granite. The blocking in many cases is produced by the granite veining.

Intruding both the gabbro and the older metavolcanic rocks, are granitic rocks which form the northern part of the Chambers–Strathy batholith. Modal analyses of the granitoid rocks indicate a massive, equigranular granite composition according to the Streckeisen (1976) classification. These rocks also occur in adjacent Strathy Township and were referred to as quartz monzonites by Bennett (1978), presumably under a different classification scheme. Along the southern margin of the volcanic belt, the outcrops of metavolcanic rocks likely represent rafting or roof pendant development near the top of the intrusion. Contacts are sharp, slightly irregular and are characterized by zones of narrow, subparallel intercalations of volcanic and granitic material. Zones of extensive migmatization also extend along the northern boundary of Banting Township, close to Anima–Nipissing and Mannajigama lakes. This area may also represent a roof pendant zone along the southern boundary of another volcanic belt which occurs in southern Brigstocke Township (Born and Burbidge 1987).

The degree of granite veining and diking in the volcanic rocks increases towards the main intrusive body. Passive block stoping of volcanic material during emplacement has also resulted in development of agmatitic structures similar to those described both in the nearby Maple Mountain area and Brigstocke Township by Card et al. (1973) and Born and Burbidge (1987), respectively.

Intrusion of associated lamprophyre, minor mafic feldspar porphyry dikes, pyroxenite bodies and diatreme breccias represent late Archean igneous activity in the study area. The dikes also occur as composite bodies which contain stoped, tabular granitic xenoliths or smaller subrounded fragments, which may be indicative of *in situ* milling. A distinctive hematite-epidote alteration halo within the host Archean granitic rocks also indicates that a period of intermittent hydrothermal activity accompanied the intrusion of the lamprophyres in the Snare Creek area.

The Archean rocks have undergone a complex deformational history with a D_1 event characterized by shallow west-plunging isoclinal folds accompanied by a strong east-west axial planar foliation. This was followed by a D_2 east-northeast event which produced the dominant Anima–Nipissing River deformation zone (ANRDZ) and deflected earlier foliations parallel to this zone. Ductile deformation produced mylonitic textures in granites along this zone. The last minor deformation (D_3) is reflected by the development of sporadic north-trending minor structures and a spaced axial planar cleavage. The undeformed nature of the lamprophyre intrusions suggests emplacement following the last deformational event (D_3).

The remainder of the rocks are of Proterozoic age and undeformed. They consist of gently dipping sedimentary rocks of the Gowganda Formation (Coleman Member), Nipissing diabase sills and a variety of post-Nipissing diabase dikes.

Sediments belonging to the Coleman Member of the lower Gowganda Formation (Huronian Supergroup) unconformably overlie the Archean basement. The sediments are within a northeast-trending paleotrough that extends from the Red Squirrel Lake in the south to Anima–Nipissing Lake in the north, and Breeches Lake in the northeast part of the study area. Sedimentary facies are similar to those described from the Cobalt Camp (Mustard 1985). The predominant rock types characterzing the glaciogenic-derived Coleman Member include diamictite, pebbly sandstone and mudstone. Basal breccia occurs at a number of locations and is composed of angular fragments of underlying granitic and volcanic material. Sedimentary features, such as bedding within some of the mudstones and sandstones, exhibit shallow dips of 10° to 15°. Rare ripple marks and cross-beds indicate paleocurrent flow from the north or northeast. Other notable sedimentary features include dropstones and lenticular and convolute bedding. Deposition of diamictites and mudstones probably indicates glacial and distal marine environments, respectively.

The Nipissing diabase occurs as a distinctly zoned, gently undulating sill which dips from 10° to 15°. Differential erosion, combined with the undulating nature of the sill has resulted in the formation of two major diabase arches and two diabase basins. Field relationships also reveal the presence of a separate, thin Nipissing sill intruding Archean granitic rocks near the southeast corner of the map area. The main Nipissing sill is typically zoned, with the upper and lower contacts characterized by massive and fine-grained quartz diabase. The upper half of the sill is composed of an irregular, coarse-grained and pegmatitic varied-textured diabase and the lower half consists of medium-grained, massive hypersthene gabbro.

A distinct northwest-trending olivine diabase dike of the Sudbury swarm cuts all rock types. Several fine-grained, northwest- and northeast-trending diabase dikes also cut the sedimentary rocks of the Coleman Member. Although only the northwest set is observed cutting the Nipissing diabase, it is assumed that the northeast set is of a similar age and also intrudes the diabase.

Proterozoic rocks in the area are essentially undeformed. The presence of rare kink bands within the sediments of the Coleman Member is the only indication of any deformation.

Glacial drift throughout the area is extensive and includes both glaciofluvial and morainal deposits.

Despite a marked similarity between rocks in the study area and those of the Cobalt silver mining camp, little evidence of silver-cobalt-arsenide mineralization exists. However, detailed mapping and assaying have delineated several zones of potential economic interest. These include:

1. Quartz veins associated with strongly deformed granites with minor gold and copper mineralization. These are related to the east-northeast-trending Anima-Nipissing River deformation zone (ANRDZ). Assay values range from trace to 0.05 ounce gold per ton.
2. Quartz ± calcite veins in Nipissing diabase with minor gold, silver and copper mineralization. Examples of this type of mineralization occurs at several scattered localities, primarily south of Whitewater Lake and in the southeastern part of the area in Best Township. The veins reach a maximum of 20 cm in width and contain minor pyrite, minor chalcopyrite and malachite. Assays range up to 0.006 ounce gold per ton.
3. Hornblende gabbro with base metal and possible PGE potential. This unit could be correlative with the Net Lake intrusion located to the south in Strathy Township (Fyon et al. 1988) where several base metal occurrences are located. Of particular interest are sulphide- or magnetite-rich portions of the intrusion and the northern contact zone with the metavolcanic belt.
4. Diatreme breccia zones with possible minor gold potential. A distinctive epidote-hematite alteration halo around one of these intrusions indicates some local hydrothermal activity. Assays of the lamprophyre and adjacent rocks range up to 0.01 ounce gold per ton.

GEOLOGICAL DATA INVENTORY FOLIO (GDIF) COMPILATION

The compilation and publication of GDIFs was continued during the year under the auspices of COMDA. In 1989, folios and maps for three townships were published, and reports and maps for an additional four townships were submitted for publication. Over the past 6.5 years, GDIFs for 92 townships have been published and represent a 65 percent coverage of the Cobalt Resident Geologist's District. Twenty additional folios are now complete and available for perusal in the office. These will be published in 1990.

The folios are popular with the mining and exploration community as a first line of research into the exploration history of any particular property. Using the maps and text, one can immediately identify companies which may have performed work on a claim and find a summary of all known exploration. Additional information regarding adjacent claims can also be quickly located. References pertaining to a particular property, and to the area in general, are detailed in other sections. Office staff frequently use the GDIFs as a rapid means of identifying files needed in response to requests or to complete property searches. In addition, they are used to assist staff in locating mineral occurrences, mining activity or past activity, as an aid in land-use planning or in the variety of other requests pertaining to land use such as lot severences, transmission line routes, and hazard studies, etc.

TEMAGAMI–TEMISKAMING MINE COMPILATION PROJECT

Following the closure of the Cobalt Resident Geologist's office in the mid–1960s, little was done to obtain important deposit information from mines located on patented grounds. Few reports or descriptions of the numerous underground levels, stopes, geology, grades, tonnages, etc. were compiled, and most information was kept confidential within the mines. No public records were made available which detailed much of this information. With the recent suspension of mining activities by the major land holder in the area (Agnico-Eagle Mines Limited), permission was granted to access their records, maps and mining properties. This provided an excellent opportunity to compile much of this missing data for the public record. A number of former company geologists, familiar with the properties and location of records, were also available and are currently working on the project, which is funded by COMDA. The project was initiated in April 1989, and will be completed by April 1990. This length of time, however, only allows for the compilation of four mine property reports out of an estimated 30 similar properties in the area. The final product will be a compendium of information including descriptions of mine history, geology and production data compiled from all available information. Plans of underground workings, including longitudinal and cross sections of mined areas and geology, will accompany the report. This project should add vital information to the existing data base of an active silver mining camp. The information is also important for modelling and concept development on ore genesis, and is crucial background information to the exploration industry interested in future development and exploration at the specific mines.

Four individual reports and accompanying maps are presently being compiled. A summary of each report, with examples of map styles, production tables and diagramatic cross sections, was displayed at the Ontario Mines and Minerals Symposium in Toronto, in December 1989. Mines described in these reports include the Beaver–Temiskaming Mine at Cobalt; Castle Mine, No. 3 Shaft at Gowganda; Langis Mine at New Liskeard; and Temagami Copper Mine (Copperfields) at Temagami. A brief description of these properties follows.

The Beaver–Temiskaming Mine is located on lots 1, 2 and 3 in Concession III, Coleman Township, approximately 5 km southeast of Cobalt. The mine property consists of 19 patented claims (Robinson 1984). Both the original Beaver and Temiskaming mines were discovered in 1907, and had shafts sunk to a depth of 488 m (Sergiades 1968). The mines are on adjacent claims and have a similar ownership history. They were combined in 1955 when the Cobalt Consolidated Mining Corporation Limited bought the properties (Sergiades 1968). In 1957, this company changed names to Agnico Mines

Limited and in 1972, to Agnico-Eagle Mines Limited (Sergiades 1968). This company is the present mine operator. The current Beaver-Temiskaming Mine is an amalgamation of several adjacent properties which include the following former mines: Beaver Mine (7127858 ounces silver), Temiskaming Mine (12118796 ounces silver), Cobalt Lode Mine (4493725 ounces silver), Brady Lake Mine (3100000 ounces silver) and Christopher Mine (4100000 ounces silver). Historical production from these properties totals 30940379 ounces of silver to 1974. Since this time, the new Beaver-Temiskaming Mine has produced an additional 4549160 ounces of silver. The report and maps of this mine describe only the most recent (post-1974) exploration, development and mining activity which was confined to separate, deep workings along the lower contact of the Nipissing diabase sill.

Steeply dipping and overturned Keewatin (Archean) mafic flows and sedimentary rocks are the dominant host for ore veins. The units trend at 160° and dip 60° to 70° to the southwest. These Keewatin rocks are located on one limb of an isoclinal or monoclinal fold (Robinson in preparation).

A relatively flat-dipping Nipissing diabase sill intruded, and presumably dilated, the Keewatin volcanic rocks a minimum of 305 m in the southern portion of the property and a maximum of 347 m in the northwestern portion of the property (Robinson, in preparation). The lower contact of the sill locally follows steeply dipping Archean shear zones. The diabase, where in contact with these shear zones is, however, generally undeformed and exhibits a normal pale green, aphanitic chill zone (Robinson 1984).

Three distinct types of ore veins are present at the mine and include simple dilation, shear and replacement veins (Robinson 1984). Simple dilation veins are characterized by sharp boundaries with the host rock, exhibit near-vertical dips, lack shearing textures and show little or no movement in the plane of the vein (Robinson 1984). Shear veins normally occur within, or adjacent to, fault zones and reflect a complex history of repeated deformation, alteration and mineralization. Minerals within these veins may exhibit textures associated with deformation. The carbonate gangue is often finely banded and reduced in grain size. Replacement veins are comprised of intergrowths of dolomite, calcite and chlorite (± magnetite) which replace the host rock. They commonly occur as zones up to 2 m wide and may contain disseminated cobalt-nickel arsenides and silver. Replacement veins are rare and generally occur at the intersection of veins or within altered rock units (Robinson 1984). Individual veins can change character rapidly and exhibit features associated with any or all of the vein types described.

The No. 37 vein is an example of a shear vein and is situated along a steep contact between the chilled Nipissing diabase lower contact and underlying and adjacent Keewatin mafic volcanic rocks (Robinson 1984). Within the diabase sill, the vein occurs as a simple dilation vein, although within the volcanic rocks it exhibits all the characteristics of a shear vein. Post-ore fractures, filled with coarse, transparent calcite and grey mud, cut this vein in the 1337 North and South stopes (Robinson, in preparation). Wire silver, stephanite, pyrargyrite, argentite and polybasite are found in vugs, and are enclosed by calcite in areas where post-ore fractures cut high-grade silver mineralization. The highest ore grades tend to concentrate in areas of greatest dilation; in this instance: 1) along the trace of the No. 38, No. 41 and No. 52 veins; 2) along the inflection of the vein where the dip shallows perceptibly near the lower portion of the diabase sill; 3) along an inflection of the vein where it crosses into the diabase; and 4) directly above and below a well-defined, shallow-dipping fault.

The Castle Mine report is an update of work completed after 1978 on the Castle-Tretheway property located near Gowganda, Ontario. The 43 claims comprising this property straddle the Haultain-Nicol Township boundary. This mine, in operation since 1917, produced 2961010 ounces of silver from 109800 tons of ore in the period between 1979 and 1988. Historical production from the No. 3 Shaft to 1988 is 24617010 ounces of silver. Little has been published describing any of the workings at the Castle Mine, although several company reports are available. A very complete report by Griffis (1961) is used extensively in this study.

A complete table of post-1978 production was provided by Agnico-Eagle Mines Limited. Earlier stope production figures were unavailable, primarily because stope sections were commonly incomplete or non-existent. As a result, compiled stope production data are not complete and may lack either stope number, production data or cross sections.

The area is underlain by Archean mafic to intermediate volcanic flows which are isoclinally folded and cut by several north-trending Matachewan diabase and lamprophyre dikes. Huronian sedimentary rocks overlie the Archean basement and consist primarily of conglomerates with a pebbly, sandstone matrix. Nipissing diabase occurs as an extensive and thick undulating sill which intrudes all other rock types (Hart 1983). In the mine area, a basin of Keewatin volcanic rocks and Huronian sedimentary rocks is located above the diabase sill. This important geological feature, known as the Miller Lake basin, has been the target for silver exploration for many years.

Silver and cobalt have both been mined from the Gowganda area in the past, although small quantities of copper, zinc, lead, nickel, bismuth, antimony and gold also occur within the veins (Moore 1956). The ore consists of native silver, silver-cobalt arsenides, silver sulphides and oxides in carbonate veins. Generally, the highest grade silver ore occurs with the Ni-Co-As assemblage (Petruk 1971a).

Ore veins are predominantly formed within joints and fractures cutting the Nipissing diabase sill. The orientation of the veins is controlled by the dip of the diabase sill, since both cylindrical and planar joint sets occur perpendicular to the Keewatin-Nipissing contact

(McIlwaine 1978). Because of the overall shallow dip of the sill, the veins are generally vertical to steeply dipping, and trend predominantly in a northeast to northwest direction (McIlwaine 1978). Veins are commonly narrow and can occur as single veins or as bifurcating or multiple branching vein systems. Within the veins, the ore is generally richest at structural junctions such as geological contacts, faults and joints (Petruk 1971b). Where parallel veins occur, one or both veins may have ore concentrations at different elevations. Veins may extend for 100 m or more but ore shoots are commonly quite narrow and restricted. As with veins in the Cobalt Camp, the ore shoots are very rich but limited in size, and in Gowganda average 30 to 60 m in both length and height.

The Langis Mine was first discovered in 1906 and is located in Casey and Harris townships, northeast of New Liskeard. Silver production has been continuous, except for the periods 1923–1940 and 1948–1956, and totals 10.5 million ounces.

Keewatin mafic volcanic flows (massive, pillowed and pyroclastic) and interflow sediments form the dominant basement rock in the area (Jambor 1971). A variety of younger, narrow pre–Algoman dikes intrude these rocks. Conglomerate and thinly laminated pebbly wackes of the Huronian Gowganda Formation (Coleman Member) unconformably overlie the basement. All rocks are intruded by a shallow east-dipping Nipissing diabase sill. Silurian limestone unconformably rests on these rocks in scattered locations near the mine.

A strong regional fault system in the area is characterized by north- to northwest-trending faults which extend for hundreds of kilometres, as well as a weaker set of northeast-trending faults (Andrews et al. 1986). These faults are believed to have been active in late Archean times; before, during and after Huronian sedimentation; and during and after intrusion of the Nipissing diabase (Andrews et al. 1986).

The veins consist of silver, cobalt and arsenides in a gangue of calcite, dolomite and quartz, with calcite as the most prominent gangue component. The carbonate varies in colour from white to pink to grey, and is occasionally black, due to inclusions. The most important ore minerals is native silver, although argentite can constitute up to 30 percent of the ore. All the ore occurs within steeply dipping veins which are generally productive over lengths of less than 125 m and vertically occur within 50 m of the unconformity (Thomson 1965). These steeply dipping structures cut all three major rock types and are found in simple fractures, or in faults, and are categorized as either single-vein or multiple-vein type structures (Jerome 1969).

The Temagami Mining Company Limited, later known as the Copperfields Mining Company Limited, discovered and mined a copper deposit on an island in Lake Temagami, located in the northeast corner of Phyllis Township. The property extends into the surrounding townships of Joan, Briggs and Yates, and at the time of closure consisted of 205 claims. Copperfields Mining Corporation Limited was merged with Teck Corporation in July 1983.

The Temagami Copper Mine was quite rich and mined continuously from February 1956 to February 1972. The original orebody was composed almost entirely of pure chalcopyrite and mined from two open pits. A 65-ton bulk sample, taken in 1955, yielded a grade of 29.34 percent copper, 2.5 ounces silver per ton, 0.16 ounce gold per ton and 0.2 ounce PGE per ton (The Northern Miner, July 28, 1955). A four-compartment shaft was also put down to a final depth of 2516 feet with 13 levels and two sublevels (Northern Miner Press 1972). Work is presently being carried out on the property by Greater Temagami Mines Limited and consists of relogging and sampling of old core, geophysical and geochemical surveys, and diamond drilling.

All the mine's ore was shipped to the Noranda Smelter prior to the building of an operational mill in 1959. This high-grade crude ore totalled 22060 tons grading 24.2 percent copper, 0.10 ounce gold per ton and 0.98 ounce silver per ton (Northern Miner Press 1962) and contained approximately 10677040 pounds of copper, 2206 ounces of gold and 21620 ounces of silver. From mid–1959 until operation ceased on February 15, 1972, the company's mill processed a further 672482 tons of ore containing 76982986 pounds of copper, 175979 ounces of silver and 9125 ounces of gold. These combined figures provide a total production of 694542 tons containing 87660026 pounds of copper, 197599 ounces of silver and 11331 ounces of gold.

DIAMOND-DRILL CORE STORAGE PROGRAM

In 1989, 1216.3 m of core was donated to the Cobalt Drill Core Library by three companies. The total footage now stored at the facility is 19507.7 m. Racks are now filled to capacity and telescoping of core will begin next summer. An additional 10700 m of palletized core still remains in storage at the Kirkland Lake Drill Core Library. The drill core collection of Shearman Mine was offered to the library but could not be accepted until alternate or additional storage space is found. All drill hole and borehole core from the extensive Cobalt mining hazards testing program by Golder and Associates is presently stored at the core library. Table 14.3 provides a township-by-township inventory of core that is available for viewing at the core library and Figures 14.1a, 14.1b and 14.1c provide locations of the holes.

RECOMMENDATIONS FOR EXPLORATION

The Shining Tree area continued to attract attention because of the high gold potential in the central part of the belt and base metal potential in the largely unmapped areas to the north. The structurally complex mafic to intermediate metavolcanic belt merits further study, with particular attention paid to fault-related alteration zones within oxide-facies iron formation. Recently ex-

TABLE 14.3 SUMMARY OF DRILL CORE STORED IN THE COBALT DRILL CORE LIBRARY.

TOWNSHIP	TOTAL HOLES	TOTAL LENGTH (METRES)
Armstrong	1	16.2
Bucke	54	5042.2
Casey	1	82.0
Churchill	3	326.9
Coleman	209	3424.0
Dymond	1	300.4
Firstbrook	24	4717.5
Harley	4	61.8
Harris	9	797.9
Lorrain	11	1196.4
Mattawan	3	377.5
South Lorrain	2	900.9
Strathcona	7	1184.9
Strathy	21	1079.1
	---	-------
TOTAL	350	19507.7

posed outcroppings of these rocks, along the Grassy Lake Road in Macmurchy, Churchill and Kemp townships, returned anomalous gold and silver assay values. Regional geophysical surveys may be warranted to locate possible deep-seated mafic and ultramafic intrusive igneous bodies in parts of the Shining Tree area covered by vast tracts of deep overburden (northern and western areas). Altered or magmatically segregated zones within these units are potential targets for nickel, copper and PGE mineralization.

In the Englehart area, the potential for locating new gold occurrences in both Keewatin volcanic rocks and adjacent granitic intrusions is quite high. According to Johns (1986), all rusty shear zones in metavolcanic rocks, as well as a northest-trending fault system (the Palmer–Vaughan–Estival break) in Bryce Township and Tudhope Township, should be examined in detail because of the number of gold showings which occur along these structures. Carbonatized shear zones, especially in the vicinity of Heather, Pike and Honeymoon lakes, have been prime exploration targets in recent years and have yielded a number of new gold occurrences and gold values in soil and basal till sampling. An exposure of very coarse, unsorted pyroclastic rocks in the Heather Lake area suggests the presence of a possible volcanic vent within the Archean Skead Group and can be considered a favourable location for the deposition of massive sulphides (Johns 1986).

Grenville-aged rocks in the Temagami–North Bay areas host occurrences of base metals in ultramafic intrusive rocks, and occurrences of industrial minerals such as silica, mica, kyanite, feldspar-bearing pegmatites, and building stone. This latter group represents a popular and interesting alternative to precious metal exploration and deserves some consideration. Also, in this area, good potential exists for the occurrence of kimberlites which are a possible source of diamonds.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

GEOPHYSICS/GEOCHEMISTRY SECTION

J.E. Hanneson completed a COMDA-funded study in the Cobalt area which focussed on using electromagnetic surveys to trace Keewatin-age conductive interflow sediments buried below thick deposits of Huronian-age sediments. A UTEM (transient electromagnetic) survey was completed over a 4 km^2 area (Block A) near McLaren Lake in Firstbrook and Coleman townships. Preliminary maps illustrating profile data and conductor locations were subsequently released (Hanneson and Huxter 1989; Hanneson et al. 1989). A later gravity survey over the same area was also completed and data released recently (Hanneson and Rowe 1989).

PRECAMBRIAN GEOLOGY SECTION

P. Born completed a multiyear COMDA-funded mapping program in the Temagami–Cobalt area, designed to evaluate mineral potential and update the geological data base for townships that were previously mapped in 1926. The preliminary maps for Brigstocke and Kittson townships were previously released (Born and Burbidge 1988) and a geological report on the area is in press. A geological report and maps for Cassels and Riddell townships were recently published (Born 1989a, 1989b) and those for the Bay Lake area are presently in press (Born and Hitch, in press).

J.A. Fyon is in the final stages of completing a multiyear COMDA-funded investigation of rock and mineral occurrences in Strathy, Chambers, Briggs and Strathcona townships. The final maps and reports are presently being completed and the Chambers Township map has recently been released (Fyon et al. 1989).

R.J. Rice completed a COMDA-funded study investigating the sedimentary and paleoplacer gold potential of the Lorrain Formation. The primary objective of this project was to determine whether or not the Lorrain Formation represented a marine or fluvial system and to determine the potential for hosting paleoplacer gold deposits. The final report is scheduled for completion in 1990.

D.M. Conrod completed an investigation of Nipissing diabase intrusions over an area extending from Sault Ste. Marie to Cobalt. The results will be published in 1990.

R.M. Easton collected samples, to be used in future age-dating determinations, from Grenville-age rocks in the Tomiko–North Bay area. Results are to be included in *The Geology of Ontario*.

M.C. Carter recently published a final map and report of the immediate Shining Tree area. This map and report were originally released in preliminary form in 1980 (Carter 1989a, 1989b).

ENGINEERING AND TERRAIN GEOLOGY SECTION

P.W. Alcock concluded a COMDA-funded program of quaternary mapping and till sampling in the Shining

Tree area with the mapping of the area covered by the Gowganda sheet (NTS 41 P/10). It was noted that heavy drift, characteristic of the Shining Tree area, generally ended at the boundary between volcanic rocks and Lorrain Formation sediments. Till sampling was primarily located near old silver mines. The preliminary map is presently being completed. Work on the quaternary geology of the Sinclair Lake area (NTS 41 P/14), which was completed in 1988, is now being prepared. The final report for the project will include both the Shining Tree and Gowganda areas.

GEOSCIENCE LABORATORIES SECTION

Results of a petrogenetic study of the Nipissing diabase in the Cobalt area were published by P.C. Lightfoot in co-operation with the University of Toronto and the Mineral Resources Division of the Geological Survey of Canada (Lightfoot and Naldrett 1989). Geochemical studies suggest that variations in mineralization are unrelated to primary igneous processes, and that magmas, which were possibly derived from an old enriched zone of mantle, were virtually uncontaminated by crustal material as they migrated to the surface. There is no indication that the magma carried any silver, copper or other metal, but contemporaneous mobilization of the metals in areas such as Cobalt may have occurred as a result of the diabase emplacement. Uranium-lead dating of baddelyite fractions from two sills carrying the N_1 and N_2 paleomagnetic directions, respectively, revealed a significant difference in the emplacement ages of about 10 Ma.

RESEARCH BY OTHER AGENCIES

CARLETON UNIVERSITY

D. Marshall is continuing an MSc thesis project which describes fluid inclusions from silver-arsenide ore veins obtained from the Beaver–Temiskaming, Hellens–Eplett and Castle silver mines in Cobalt and Gowganda.

K. Venance completed petrographic studies of samples collected at the Little Silver vein in Cobalt as part of a BSc thesis project (Venance 1989).

LAURENTIAN UNIVERSITY

D.J. Brons completed a study describing the stratigraphy and metamorphism of mafic volcanic rocks in a part of the Temagami greenstone belt as part of an MSc thesis.

R. Nordin is continuing research as part of an MSc thesis describing the geochemistry and alteration at the Tyranite Gold Mine, located in Tyrrell and Knight townships.

McMASTER UNIVERSITY

M. Baknes is continuing an MSc thesis project describing the geochemistry of an anomalous Archean copper- and molybdenite-enriched breccia pipe. The pipe is located at the contact between mafic volcanic rocks and the Strathy granite batholith near Temagami North (Goward) in Strathy Township. The breccia, consisting of a quartz matrix and volcanic fragments, is relatively unaltered, but contains distinctive zones of feldspathic-rimmed fragments. The research should be completed in the spring of 1990.

R.J. Bowens recently submitted a PhD thesis describing geochemical studies of banded iron formation in the Sherman Mine area.

UNIVERSITY OF OTTAWA

G. Burbidge continued work on a PhD thesis project investigating the sedimentology of the glaciogenic facies of the Coleman Member of the Gowganda Formation. No field work was undertaken this summer. It is expected that the research will be completed soon.

UNIVERSITY OF WESTERN ONTARIO

J. Aultman completed a BSc study investigating gold dispersal in till, occurring down-ice from a known gold occurrence located near Shining Tree.

SELECTED PUBLICATIONS RECEIVED

Alcock, P.W. 1988. Quaternary geology of the Shining Tree area, districts of Sudbury and Timiskaming; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.411-413.

Betournay, M.C. 1989. Surface crown pillar evaluation for active and abandoned metal mines; International Conference Proceedings, 1989, Ontario, 216p.

Blackburn, C.E., Hailstone, M.R., Parker, J. and Storey, C.C. 1987. Kenora Resident Geologist's area, Northwestern Region; *in* Report of Activities 1986, Regional and Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 134, p.1-33.

Born, P. 1989a. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Report 271, 73p.

——1989b. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Map 2526, scale 1:20000.

Born, P. and Hitch, M.W. 1988. Geology of the Bay Lake area, District of Timiskaming; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.281-287.

Brodaric, B. and Fyon, J.A. 1988. Field implementation of a developmental computer-based digital mapping and data storage system; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.378-380.

Bursnall, J.T. ed. 1989. Mineralization and shear zones; Geological Association of Canada, Short Course Notes Volume 6.

Carter, M.W. 1989a. Geology of the Shining Tree area, districts of Sudbury and Timiskaming; Ontario Geological Survey, Report 240, 48p.

——1989b. Shining Tree area (41 P/11), districts of Sudbury and Timiskaming; Ontario Geological Survey, Map 2510, scale 1:50000.

Cattalani, S. and William-Jones, A.E. 1989. Geological, fluid inclusion, and stable isotopic studies of the St. Robert W-Ag-Bi vein deposit, Eastern Townships, Quebec; Geological Survey of Canada, Open File Report 2049, 73p.

Ciesielski, A. and Madore, C. 1988. Litho-tectonic map of the Grenville Front, the Archean parautochthonous orthogneisses and Proterozoic dykes in the central Grenville Province, southeast of Chibougamau, Quebec; Geological Survey of Canada, OFR 2059, 1:500000.

Colvine, A.C. 1974. The petrology, geochemistry and genesis of sulphide related alteration at the Temagami Mine, Ontario; unpublished PhD thesis, University of Western Ontario, London, 204p.

Committee of Provincial Geologists. 1988. Provincial Geologists Journal, v.6, 141p.

Conrod, D.M. 1988. Petrology, geochemistry, and platinum group element potential of the Portage Bay, Cross Lake, and Bonanza Lake Nipissing intrusions of northern Ontario; unpublished MSc thesis, University of Toronto, Toronto, 494p.

——1989. Petrology and geochemistry of the Duncan Lake, Beaton Bay, Miller Lake, and Miller Lake Nipissing intrusions within the Gowganda area; Ontario Geological Survey, Open File Report 5701, 210p.

Easton, R.M. 1988. Regional mapping and stratigraphic studies, Grenville Province, with some notes on mineralization environments; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.300-308.

Fyon, J.A., Hrabi, R.B. and Maitland, W.M. 1988. Relationships between lithological, alteration, and structural features and precious metal occurrences in the Temagami greenstone belt, District of Nipissing; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.212-218.

Fyon, J.A., Hrabi, R.B. Maitland, W.N. and Cole, S.F. 1989. Geology of Chambers Township; Ontario Geological Survey, Open File Map 125, scale 1:20000.

Fyon, J.A. and Wheatley, K.J. 1988. Petrographic characteristics of Archean granitoid rocks; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.381-383.

Garland, G.D. ed. 1989. Proceedings of exploration '87, third decennial international conference on geophysical and geochemical exploration for minerals and groundwater; Ontario Geological Survey, Special Volume 3, 960p.

Golder Associates Limited. 1985. Report to Knox, Martin Kretch Ltd. on evaluation of bedrock conditions along water main alignments, Cobalt, Ontario; unpublished company report 851-1172, 22p.

——1987a. Report to Knox, Martin, Kretch Ltd., Contract 2, geotechnical investigation, Cobalt water storage tank, Cobalt, Ontario; unpublished company report 861-1255-2, 12p.

——1987b. Report to Knox, Martin, Kretch Ltd., Contract 3, geotechnical investigation, proposed trunk watermains, Lang Street and Hudson Bay Street areas of the northeast part of Cobalt, Cobalt, Ontario; unpublished company report 861-1255-3, 19p.

——1987c. Report to Knox, Martin, Kretch Ltd., Contract 4, geotechnical investigation, proposed trunk watermains, north and west parts of Cobalt (including north of Prospect Avenue from existing pumping station intake to Galena Street), Cobalt, Ontario; unpublished company report 861-1255-4, 19p.

——1987d. Report to Knox, Martin, Kretch Ltd., Contract 5, geotechnical investigation, proposed trunk watermains, central part of Cobalt (from Galena Street to Argentite Street), Cobalt, Ontario; unpublished company report 861-1255-5, 30p.

——1987e. Report to the Mayor and Council, Town of Cobalt on preliminary engineering assessment and suggested remedial measures "P-S" stope intersection crown pillar, Hwy 11B, Cobalt, Ontario; unpublished company report 871-1289, 14p.

——1987f. Report to the Mayor and Council, Town of Cobalt on subsurface drilling investigation, factual results, Phase I, "P-S" stope intersection and adjacent areas of Highway 11B, southwest of Galena St., Cobalt, Ontario; unpublished company report 871-1289-1, 7p.

——1988a. Report to the Mayor and Council, Town of Cobalt on subsurface investigations and preliminary engineering assessment, Phase II, Highway 11B Corridor, Galena Street/Miller Avenue intersection area, Cobalt, Ontario; unpublished company report 871-1347-1, 23p.

——1988b. Report to the Ministry of Housing on subsurface investigations and preliminary engineering assessment, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 871-1445, 16p.

——1988c. Report to the Mayor and Council, Town of Cobalt on subsurface investigations and appraisal of mining records for Phase III, Highway 11B Corridor evaluation, Cobalt, Ontario; unpublished company report 871-1447, 17p.

——1988d. Report to the Mayor and Council, Town of Cobalt on hazard evaluation of #1 and #3 vein stopes, Phase I, TV and ultrasonic inspection from shaft pilot hole, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 881-1730, 4p.

——1988e. Report to Timiskaming Board of Education on abandoned mine workings beneath the Cobalt–Coleman School, Cobalt, Ontario; unpublished company report 881-1734, 7p.

——1988f. Report to the Mayor and Council, Town of Cobalt on hazard evaluation of #1 and #3 vein stopes, phases II-IV, shaft cage and submersible Mini-Rover inspection and outline for remedial measures, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 881-1740, 15p.

——1989. Report to the Ministry of Northern Development and Mines on mine hazard inventory for the municipality of the Town of Cobalt, Cobalt, Ontario; unpublished company report 891-1700, 17p.

Good, D.J. 1988. Platinum group element distribution in the Kanichee intrusion, District of Nipissing; Ontario Geological Survey, Open File Report 5705, 42p.

Hanneson, J.E. and Huxter, R.S. 1988. The detection and mapping of basement conductors under areas covered by thick Huronian sedimentary rocks, District of Timiskaming; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.464-469.

——1989. UTEM profile data (1987), Cobalt geophysical research project, Cobalt area, District of Timiskaming; Ontario Geological Survey, Preliminary Map P.3133, scale 1:20000.

Hanneson, J.E., Huxter, R.S. and Rowe, D.S. 1989. UTEM profile data (1988), Cobalt geophysical research project, Cobalt area, District of Timiskaming; Ontario Geological Survey, Preliminary Map P.3141, scale 1:20000.

Hanneson, J.E. and Rowe, D.S. 1989. Gravity survey (1988)—Grid A, Cobalt geophysical research project, Cobalt area, Ontario; Ontario Geological Survey, Preliminary Map P.3147, scale 1:20000.

Hart, T.R. 1983. An examination of the geology of the Castle–Trethewey property, Gowganda, Ontario; unpublished report for Agnico–Eagle Mines Limited, 50p.

Hornbrook, E.H.W. and Friske, P.W.B. 1989. Regional lake sediment and water geochemical data, central Ontario, [31E(N1/2), parts of 31K, 31L]; Geological Survey of Canada, Open File Report 1956, 7p.

Jerome, J.E. 1969. Report on Langis Silver and Cobalt Mining Company Limited, Dolphin Miller Mines Limited and other adjoining mining properties, Casey and Harris townships; unpublished internal report for Langis Silver and Cobalt Mining Company Limited, 39p.

Johnston, M.M. 1987, Stratigraphy and geochemistry of a portion of the Temagami greenstone belt, northeastern Ontario; unpublished MSc thesis, Laurentian University, Sudbury, 123p.

Leslie, C.A. 1988. The sedimentary framework of the early Aphebian Gowganda Formation, near Kenogami Lake, Ontario, Canada; unpublished MSc thesis, Laurentian University, Sudbury, 117p.

Morrison, Hershield Limited. 1987. Pre-condition survey, Cobalt, Ontario; unpublished company report #387-05781, 7p.

Ontario Geological Survey. 1988. Summary of field work and other activities 1988; Ontario Geological Survey, Miscellaneous Paper 141, 498p.

——1989a. Summary of field work and other activities 1989; Ontario Geological Survey, Miscellaneous Paper 146, 275p.

——1989b. Index to Geological Data Inventory Folios, Northeastern Region, current to May, 1989; Ontario Geological Survey, scale 1:1500000.

Owsiacki, L., Cosec, M. and Anderson, D.P. 1989. Cobalt Resident Geologist's District—1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.301-326.

Owsiacki, L., Smyk, M.C. and Born, P. 1989. Geology and mineral potential of Banting Township and the western part of Best Township; Ontario Geological Survey, Open File Map 124, scale 1:20000.

Rice, R.J. 1988. Regional geology and sedimentology of the Lorrain Formation, Cobalt plain: southeastern and southern outliers; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous paper 141, p.288-296.

Thomson, R. 1961. Preliminary report on parts of Coleman Township and Gillies Limit near New Lake, southeast of Cobalt, District of Timiskaming; Ontario Department of Mines, Preliminary Report 1961-2, 25p.

Shklanka, R. ed. 1969. Copper, nickel, lead and zinc deposits of Ontario; Ontario Department of Mines, Mineral Resources Circular 12, 349p.

Storey, C.C. 1986. Building and ornamental stone inventory in the districts of Kenora and Rainy River; Ontario Geological Survey, Mineral Deposits Circular 27, 168p.

REFERENCES

Andrews, A.J., Owsiacki, L., Kerrich, R. and Strong, D.F. 1986. The silver deposits at Cobalt and Gowganda, Ontario. I: Geology, petrography and whole-rock geochemistry; Canadian Journal of Earth Sciences, v.23, no.10, p.1480-1506.

Bennett, G. 1978. Geology of the northeast Temagami area, District of Nipissing; Ontario Geological Survey, Report 163, 129p.

Born, P. 1989a. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Report 271, 73p.

——1989b. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Map 2526, scale 1:20000.

Born, P. and Burbidge, G.H. 1987. Geology of Brigstocke and Kittson townships, District of Timiskaming; *in* Summary of Field Work and Other Activities 1987, Ontario Geological Survey, Miscellaneous Paper 137, p.198-204.

Born, P. and Hitch, M.W. In Press. Geology of the Bay Lake area, District of Timiskaming; Ontario Geological Survey, Report.

Card, K.D., McIlwaine, W.H. and Meyn, H.D. 1973. Geology of the Maple Mountain area, Operation Maple Mountain, districts of Timiskaming, Nipissing, and Sudbury; Ontario Division of Mines, Geological Report 106, 160p.

Carter, M.W. 1977. Geology of Macmurchy and Tyrrell townships, districts of Sudbury and Timiskaming; Ontario Division of Mines, Geological Report 152, 69p.

——1980. Geology of Connaught and Churchill townships, District of Sudbury; Ontario Geological Survey, Report 190, 81p.

——1989a. Geology of the Shining Tree area, districts of Sudbury and Timiskaming; Ontario Geological Survey, Report 240, 48p.

——1989b. Shining Tree area (41 P/11), districts of Sudbury and Timiskaming; Ontario Geological Survey, Map 2510, scale 1:50000.

Chesbar Resources Incorporated 1989. Annual Report for 1988; unpublished company report, 24p.

Fyon, J.A., Hrabi, R.B. and Maitland, W.M. 1988. Relationships between lithological, alteration, and structural features and precious metal occurrences in the Temagami greenstone belt, District of Nipissing; *in* Summary of Field Work and Other Activities 1988, Ontario Geological Survey, Miscellaneous Paper 141, p.212-218.

Fyon, J.A., Hrabi, R.B., Maitland, W.N. and Cole, S.F. 1989. Geology of Chambers Township; Ontario Geological Survey, Open File Map 125, scale 1:20000.

Golder Associates Ltd. 1987e. Report to the Mayor and Council, Town of Cobalt on preliminary engineering assessment and suggested remedial measures "P-S" stope intersection crown pillar, Hwy 11B, Cobalt, Ontario; unpublished company report 871-1289, 14p.

——1988b. Report to the Ministry of Housing on subsurface investigations and preliminary engineering assessment, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 871-1445, 16p.

——1988c. Report to the Mayor and Council, Town of Cobalt on subsurface investigations and appraisal of mining records for Phase III, Highway 11B Corridor evaluation, Cobalt, Ontario; unpublished company report 871-1447, 17p.

——1988d. Report to the Mayor and Council, Town of Cobalt on hazard evaluation of #1 and #3 vein stopes, Phase I, TV and ultrasonic inspection from shaft pilot hole, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 881-1730, 4p.

——1988e. Report to Timiskaming Board of Education on abandoned mine workings beneath the Cobalt-Coleman School, Cobalt, Ontario; unpublished company report 881-1734, 7p.

——1988f. Report to the Mayor and Council, Town of Cobalt on hazard evaluation of #1 and #3 vein stopes, phases II-IV, shaft cage and submersible Mini-Rover inspection and outline for remedial measures, Senior Citizens' Building, Cobalt, Ontario; unpublished company report 881-1740, 15p.

Grant, W.T. and Owsiacki, L. 1987. An evaluation of the Lake Timiskaming Paleozoic outlier for potentially exploitable limestone and dolostone deposits; Ontario Geological Survey, Open File Report 5661, 153p.

Griffis, A.T. 1961. Geology of the Castle Mine; McIntyre Porcupine Mines Limited, unpublished company report, 38p.

Hanneson, J.E. and Huxter, R.S. 1989. UTEM profile data (1987), Cobalt geophysical research project, Cobalt area, District of Timiskaming; Ontario Geological Survey, Preliminary Map P.3133, scale 1:20000.

Hanneson, J.E., Huxter, R.S. and Rowe, D.S. 1989. UTEM profile data (1988), Cobalt geophysical research project, Cobalt area, District of Timiskaming; Ontario Geological Survey, Preliminary Map P.3141, scale 1:20000.

Hanneson, J.E. and Rowe, D.S. 1989. Gravity survey (1988)—Grid A, Cobalt geophysical research project, Cobalt area, Ontario; Ontario Geological Survey, Preliminary Map P.3147, scale 1:20000.

Hart, T.R. 1983. An examination of the geology of the Castle-Trethewey property, Gowganda, Ontario; unpublished report for Agnico-Eagle Mines Limited, 50p.

Jambor, J.L. 1971. General geology; The Canadian Mineralogist, v.11, pt.1, p.12-33.

Jerome, J.E. 1969. Report on Langis Silver and Cobalt Mining Company Limited, Dolphin Miller Mines Limited and other adjoining mining properties, Casey and Harris townships; internal report for Langis Silver and Cobalt Mining Company Limited, 39p.

Johns, G.W. 1986. Geology of the Hill Lake area, District of Timiskaming; Ontario Geological Survey, Report 250, 100p.

Lightfoot, P.C. and Naldrett, A.J. 1989. Assimilation and fractionation in basic magma chambers: significance of trace element and near Nd-isotopic data from the Nipissing diabase, Ontario, Canada; Canadian Journal of Earth Sciences, v.26, p.737-754.

McIlwaine, W.H. 1970. Geology of South Lorrain Township; Ontario Department of Mines and Northern Affairs, Geological Report 83, 95p.

——1978. Geology of the Gowganda Lake-Miller Lake area, District of Timiskaming; Ontario Geological Survey, Report 175, 161p.

Moore, E.S. 1956. Geology of the Miller Lake portion of the Gowganda silver area; Ontario Department of Mines, Annual Report, 1955, v.64, pt.5, 41p.

Moorhouse, W.W. 1944. Geology of the Bryce-Robillard area; Ontario Department of Mines, Annual Report, 1941, v.50, pt.4, 50p.

Morrison, Hershield Limited. 1987. Pre-condition survey, Cobalt, Ontario; unpublished company report 387-05781, 7p.

Mustard, P.J. 1985. Sedimentology of the lower Gowganda Formation Coleman Member (Early Proterozoic) at Cobalt, Ontario; unpublished MSc thesis, Carleton University, Ottawa, 143p.

Northern Miner Press Ltd. 1962. Canadian Mines Handbook 1962–1963; Northern Miner Press Ltd., Toronto, 320p.

——— 1972. Canadian Mines Handbook 1972–1973; Northern Miner Press Ltd., Toronto, 416p.

Owsiacki, L. 1983. Geology of the McLean Lake area; *in* Summary of Field Work 1983, Ontario Geological Survey, Miscellaneous Paper 116, p.250-252.

——— 1984. Geology of the McLean Lake–Lundy Lake area, Nipissing District; *in* Summary of Field Work 1984, Ontario Geological Survey, Miscellaneous Paper 119, p.237-241.

Owsiacki, L. and Anderson, D.P. 1988. Cobalt Resident Geologist's area – 1987; *in* Report of Activities 1987, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 138, 367p.

Owsiacki, L., Cosec, M. and Anderson, D.P. 1989. Cobalt Resident Geologist's District – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.301-326.

Owsiacki, L., Smyk, M.C. and Born, P. 1989. Geology and mineral potential of Banting Township and the western part of Best Township; Ontario Geological Survey, Open File Map 124, scale 1:20000.

Petruk, W. 1971a. Mineralogical characteristics of the deposits and textures of the ore minerals; The Canadian Mineralogist, v.II, pt.1, p.108-139.

——— 1971b. Depositional history of the ore minerals; The Canadian Mineralogist, v.II, pt.1, p.396-401.

Robinson, D.R. 1984. General geology of the Beaver–Temiskaming Mine, Cobalt, Ontario; *in* Field Trip 4: Geology, Silver, and Gold Deposits: Cobalt and Kirkland Lake, Geological Association of Canada–Mineralogical Association of Canada Joint Annual Meeting, 1984, p.17-29.

——— In Prep. Beaver–Temiskaming Mine; *in* Temagami–Timiskaming Mine Compilation Report, Ontario Geological Survey, Open File Report.

Sergiades, A.O. 1968. Silver cobalt calcite vein deposits of Ontario; Ontario Department of Mines, Mineral Resource Circular 10, 490p.

Smyk, M.C. and Owsiacki, L. 1986. Geology of Banting Township and the western part of Best Township; Ontario Geological Survey, Miscellaneous Paper 132, p.292-296.

Streckeisen, A. 1976. To each plutonic rock its proper name; Earth Science Reviews, v.12, p.1-33.

Stroud Resources Limited. 1989. Annual Report for 1988, 16p.

Thomson, R. 1965. Casey and Harris townships, Ontario Department of Mines, Geological Report 36, 77p.

Venance, K. 1989. Petrology of Coleman Formation metasediments at the Little Silver Vein near Cobalt, Ontario; unpublished BSc thesis, Carleton University, Ottawa.

15. Sudbury Resident Geologist's District—1989

W. Meyer[1], L.B. Jerome[2], B.I. Gates[2] and J.K. Lacey[2]

[1]Resident Geologist, Sudbury Resident Geologist's Office, Northeastern Region.

[2]Geologist, COMDA, Sudbury Resident Geologist's Office, Northeastern Region.

INTRODUCTION

Nickel-copper-precious metal mining by Inco Limited and Falconbridge Limited continued to dominate mining activity in the Sudbury District. High nickel prices throughout the year assured high profits for the two companies.

The Indusmin Division of Falconbridge Limited continued to produce high-grade silica on Badgeley Island near Killarney and Standard Aggregates Incorporated produced high-quality dolostone at the western end of Manitoulin Island.

Falconbridge's T.L. Exploration shaft at the Lindsley property in Blezard Township reached a depth of 811 m by the end of November, just short of the halfway mark of the planned final depth of 1660 m.

Two new major mining developments were announced in 1989. Falconbridge Limited will bring the Craig orebody to production by 1993, and Inco Limited will bring a new mine, the McCreedy East, to a fully operational status by 1996.

Ownership of Falconbridge Limited changed hands again; the company is now controlled by Noranda Inc.

The use of public roads and highways by Inco Limited and Falconbridge Limited, to move increasing amounts of ore and concentrate by trucks to fewer centrally located processing plants, continued to cause concern in the communities of the Regional Municipality of Sudbury.

Claim staking was at a slightly reduced level from the year before.

Falconbridge Limited and Inco Limited continued to explore their extensive patented land holdings for nickel, copper and precious metals. Falconbridge Limited also had programs to explore for base metals within the Sudbury Basin.

Interest in platinum remained high, with BP Canada Inc., Inco Limited and Falconbridge Limited being the main participants. Interest in gold was lower than in previous years.

Building stone activity continued at a high level, as seven companies or individuals were at various stages of exploration, testing, promotion or production. Canadian Shield Quarries Ltd. operated a black granite quarry near River Valley. Peter Ellero and Son Limited completed expansion of their fabricating plant in 1988 and Khouri Granite Limited opened a new plant in Sudbury in 1989. These developments allow material to be test-cut and polished locally.

The new Ontario Prospector Assistance Program (OPAP), announced by the Provincial Government is proving popular. It is bringing many small prospectors back into grass roots exploration.

MINING ACTIVITIES

THE PRICE OF NICKEL

Sudbury's fortunes to some extent still depend on the price of nickel, even if this is less so than in earlier years. In 1989 the price stayed high (average US$6.04 a pound) for most of the year.

Predictions for 1990 are that nickel demand may be slightly higher than new supplies. Furthermore, nickel inventories worldwide are at low levels. This should assure that the price will also stay high for most of 1990, or at least not drop to the low levels attained during 1986 and 1987.

COMPANY NEWS

Inco Limited and Falconbridge Limited operate worldwide, but both companies have their main operations in Sudbury. Whatever happens to the two companies remote from Sudbury eventually has an impact here. Both companies were highly profitable in 1989 and the healthy financial situation lets the two companies and the communities of the Sudbury area face the future with some confidence. Major expansion plans announced in the last two years attest to this.

Inco Limited reported earnings of US$601.3 million for the first nine months of 1989, compared with US$516.4 million for the same period in 1988 and US$50.2 million in 1987. The company continues to hold about a one-third share of the world's nickel market from all operations. Inco Limited has other major nickel mining operations in Manitoba and Indonesia.

Falconbridge Limited reported earnings of $351 million in the first nine months of 1989, compared with $217 million in the same period in 1988 and $29.9 million in 1987. Falconbridge derives its revenues from three major operations: nickel-copper mining in Sudbury, the Kidd Creek copper-zinc mine at Timmins and a nickel-laterite mine in the Dominican Republic. The company holds about a 14 percent share of world nickel markets.

A prolonged takeover bid finally came to a head in September, when a consortium, consisting of Noranda

Inc. and Trelleborg AB of Sweden, bought all outstanding shares of Falconbridge Limited for $37.00 a share. This topped an earlier $36.12 a share bid by Amax Inc. What effect, if any, this change in ownership will have on day to day operations in Sudbury will remain to be seen.

NICKEL-COPPER-PRECIOUS METALS MINING

Production of nickel, copper and precious metals by Inco Limited and Falconbridge Limited continued to dominate mining activities in the area. Accurate production statistics for nickel and copper are not available. Production from all mines is currently thought to total about 280 million pounds of nickel, and 250 million pounds of copper per year. The Sudbury area annually produces about 150000 ounces of by-product platinum. This amount makes Sudbury the third largest platinum producer in the world.

Inco Limited operated nine underground mines, two open pits, three mills, one smelter, two refineries and one strip rolling mill (*see* Figure 15.2). Inco treats about 50000 tons of ore a day from all mines, but does not publish nickel and copper production figures for its Sudbury operations. The company's annual nickel production in Sudbury is thought to be about 210 million pounds. The company employed about 8000 people in the Sudbury area throughout 1989.

As part of a consolidation of milling operations, and to comply with new antipollution regulations by 1994, the Clarabelle mill is in the process of being enlarged from its present capacity of about 35000 tons per day to over 50000 tons per day by 1991. The other two mills (Copper Cliff and Frood-Stobie) are to be phased out.

The company shut down operations for five weeks from June 28, 1989, to August 8, 1989, for maintenance, modifications, and construction work.

The deep levels of the Garson mine remained closed, but the mine did produce from an open pit and from the upper levels underground, which were reached by a ramp.

In November, Inco Limited announced it will spend $179 million to bring into production an undeveloped high-grade nickel-copper orebody in the Levack area, about 50 km northwest of Sudbury. The mine is to be known as the McCreedy East. Full production is scheduled for 1996, at which time approximately 7000 tons of ore per day will be mined. This amounts to 40 million pounds of nickel, and 20 million pounds of copper a year. The mine will employ about 200 persons.

Rockbursts, again, hit Inco's Creighton mine. A 3.6 event on the Richter scale shook the mine on October 30. Tremors of a lesser intensity once again shook the lower levels of the mine on November 15. Some equipment was damaged, but nobody was injured.

Falconbridge Limited had production from five underground mines and one open pit (*see* Figure 15.2). In November, the company employed 2538 people in its Sudbury operations. Production in 1988 was just over 69 million pounds of nickel and 62 million pounds of copper from 2.86 million tons of ore. Production in 1989 is thought to have been in the same range.

The company shut down operations for two weeks from June 3, 1989, to June 17, 1989.

At the annual meeting, Falconbridge Limited announced it will spend $280 million to develop the Craig orebody in the Onaping-Levack area. Work is to be completed in 1993. The mine is then expected to produce 45 million pounds of nickel a year, which will represent about 60 percent of Falconbridge's production in the Sudbury area. Development work is to include a 4.5 km drift from the Strathcona shaft to the orebody and a 1430 m deep service and ventilation shaft.

Development work continued on the deep copper zone at the Strathcona mine. This zone contains an estimated 3.4 million tons of high-grade copper ore.

These developments are timely as Falconbridge Limited begins to phase out older operations. Late in 1989, the Falconbridge open pit closed. The East mine is to close in 1990.

The T.L. Exploration shaft on Falconbridge's Lindsley property reached a depth of 811 m by the end of November. The shaft is expected to bottom out at a depth of 1660 m sometime in 1991. It is being sunk to explore several small orebodies indicated by surface drilling. An estimate of the combined mineable ore is 7 million tons at 1.5 percent nickel and 1.5 percent copper.

THE TRUCKING ISSUE

Ongoing consolidation of surface operations into fewer centrally located plants by the two big mining companies, and the shift from rail to road transportation has resulted in more and more truck traffic on provincial highways, regional roads and city streets. Trucks move ore from mines to mills, and concentrates from mills to smelters.

The two companies are fully within their right to use public roads, but the ever larger number of trucks causes traffic congestions, safety problems and damage to road surfaces. Four persons died in 1989 in accidents involving ore or concentrate haulage trucks.

In July, Falconbridge Limited and Inco Limited jointly proposed construction of a private trucking road. It would run from the end of Frood Road to a location near the junction of Skead Road and Falconbridge Road, close to the town of Garson. Such a road will not solve all problems, but it will go a long way towards a solution. If approved, the road will be 16 km long, lie largely on company owned ground, and cost $12 to $16 million to build.

GOLD MINING

Orofino Resources Limited continued milling stockpiled ore at the Scadding mine in Scadding Township. The stockpiled ore was obtained from the "intermediate zone" in 1988 and originally consisted of about 120000 tons at 0.22 ounce gold per ton. Concentrate is shipped to the Horne smelter at Noranda, Quebec. Production in 1989 was about 5000 ounces gold. The mill handles about 170 tons of ore per day.

INDUSTRIAL MINERALS PRODUCTION

Standard Aggregates Incorporated operated its Meldrum Bay Quarry at the west end of Manitoulin Island during the Great Lakes shipping season. The company produces high-grade dolostone from a 50-foot high face in the Silurian Amabel Formation. Production in 1989 came to 2.4 million tons. The company produces 12 size grades which are shipped in Great Lakes freighters to ports in southern Ontario and the United States. Fifty-six people were employed during the shipping season.

The Indusmin Division of Falconbridge Limited continued to operate its Badgeley Island silica quarry, 4 km west of Killarney. Production in 1989 totalled 431000 tons. The coarse silica is shipped to Midland, Ontario, and Ashtabula, Ohio, for further processing. Employment numbers fluctuated, but averaged about 45 persons during the shipping season. Most of those employed are residents of Killarney.

Ethier Sand and Gravel Limited shipped 120000 tons of silica from its Alban quarry to Inco's Copper Cliff smelter. Total breakage in the quarry was 200000 tons, but Inco accepts the product only if it is larger than a certain size.

EXPLORATION ACTIVITIES

The Sudbury Resident Geologist's District encompasses about 27500 km^2 (Figure 15.1). Geologically, the district is underlain by Paleozoic, Proterozoic and Archean age rocks.

The area is well known for its large nickel-copper-precious metal mines, which are associated with the Sudbury Igneous Complex, many precious and base metal occurrences outside the Sudbury Igneous Complex, and numerous enigmatic geological features. These draw many companies, prospectors and visitors to the area each year.

In 1989, 761 newly staked claims were recorded (Table 15.2). This is below the level of 1988 when 893 claims were recorded.

Companies and individuals applied for 78 work permits for mineral exploration; 41 of these (52.5%) were held by just three companies, Falconbridge Limited, Inco Limited and BP Canada Inc.

A few of the highlights are discussed below:

Falconbridge Limited

Falconbridge Limited held work permits in 29 townships. Most work was done on long-held patented ground, few details of which have been made public.

The company spent close to $10.2 million on surface exploration and drilled 108 holes having a combined length of about 71000 m.

Falconbridge Limited signed a joint venture agreement with Giant Yellowknife Mines Limited covering further exploration and possible development of the Errington and Vermilion properties within the Sudbury Basin, southwest of Chelmsford.

The company holds a large portion of the Benny greenstone belt. In 1988, several holes were drilled, but in 1989 work was limited to line cutting, geological mapping and some geophysical surveying.

Inco Limited

Inco Limited held work permits in 16 townships. Most work done was on long-held patented ground, few details of which have been published. The company spent $4.89 million on surface exploration, and 40200 m of core was obtained from 70 drill holes.

BP Canada Inc.

BP Canada Inc. held work permits in seven townships. The company still holds about 2000 claims, which were staked in a 1987 staking rush for platinum group elements.

The company drilled six holes having a combined length of 793 m on the following claims in Harty Township: S919728, 919730, 919731, 919708 and 919712. The holes intersected sublayer quartz diorite in an area where it had not been previously mapped. The dike has an east-northeast trend, and appears to be a hitherto unknown concentric dike. Small amounts of sulphides occur in the dike, but the company did not report any metal values.

The company also drilled seven holes totalling 837 m in the southwestern corner of Tyrone Township. Six of the holes intersected sublayer quartz diorite. This drilling extends the Foy offset dike about 1 km farther north from its previously most northerly accepted termination. Small amounts of sulphides were intersected, but the company did not report any metal values.

Flag Resources (1985) Ltd.

Flag Resources (1985) Ltd. drilled three holes totalling 425 m in Rathbun Township. This was done to test magnetic and very low frequency electromagnetic (VLF-EM) anomalies and alteration zones. Rock types intersected were diabase and Gowganda Formation sedimentary rocks. The drilling did not intersect anything of economic significance.

In September, about 70 claims including the Wolf Lake and Jess Lake gold occurrences were returned to Flag Resources by Hecla Mining Co. of Canada Ltd. Flag Resources immediately moved drill equipment to the Jess Lake property in MacKelcan Township. By mid-December, the company had drilled five holes having a combined length of 3615 feet, of which, the deepest hole was 838 feet. The best results, as announced on December 8, are from hole A89-1, which intersected 0.43 ounce gold per ton over 49 feet (715 to 764 feet).

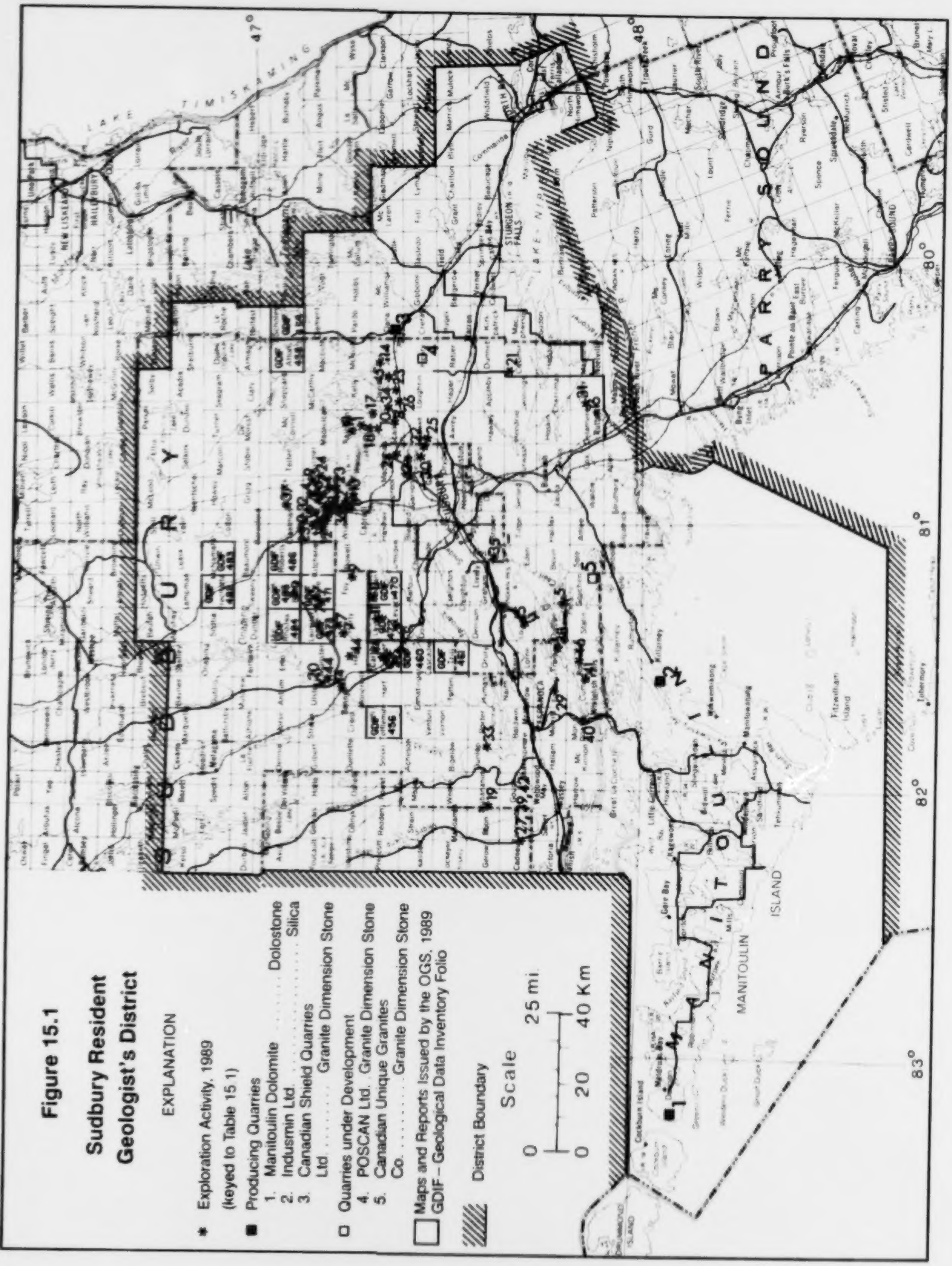

EXPLANATION
* Exploration Activity, 1989 (keyed to Table 15.1)
■ Producing Quarries
1. Manitoulin Dolomite .... Dolostone
2. Indusmin Ltd. .... Silica
3. Canadian Shield Quarries Ltd. .... Granite Dimension Stone
□ Quarries under Development
4. POSCAN Ltd. .. Granite Dimension Stone
5. Canadian Unique Granites Co. .... Granite Dimension Stone
☐ Maps and Reports Issued by the OGS, 1989
GDIF – Geological Data Inventory Folio
▨ District Boundary
Scale
0 20 40 Km
0 25 mi.
S U D B U R Y
M A N I T O U L I N
P A R R Y S O U N D
LAKE TIMISKAMING
NEW LISKEARD
HAILEYBURY
STURGEON FALLS
LAKE NIPISSING
MANITOULIN ISLAND
DRUMMOND ISLAND
Fitzwilliam Island
47°
48°
80°
81°
82°
83°

Figure 15.1

Sudbury Resident Geologist's District

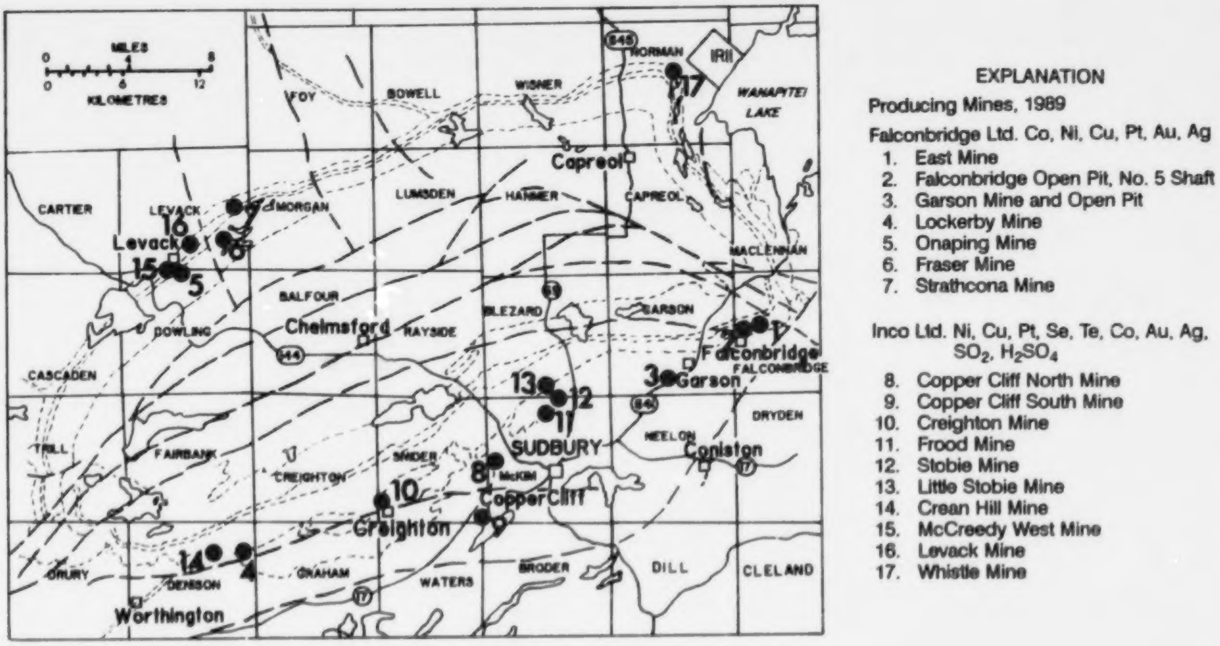

MILES
0
4
8
0
6
12
KILOMETRES
FOY
BOWELL
WISNER
NORMAN
IRII
WANAPITEI LAKE
Capreol
CAPREOL
CARTIER
LEVACK
MORGAN
LUMSDEN
HANMER
Levack
MACLENNAN
BALFOUR
BLEZARD
GARSON
DOWLING
Chelmsford
RAYSIDE
Falconbridge
FALCONBRIDGE
CASCADEN
Garson
DRYDEN
TRILL
FAIRBANK
SNIDER
NEELON
Coniston
SUDBURY
CREIGHTON
McKIM
Copper Cliff
Creighton
DRURY
DENISON
GRAHAM
WATERS
BRODER
DILL
CLELAND
Worthington
144
545
69
17
EXPLANATION
Producing Mines, 1989
Falconbridge Ltd. Co, Ni, Cu, Pt, Au, Ag
1. East Mine
2. Falconbridge Open Pit, No. 5 Shaft
3. Garson Mine and Open Pit
4. Lockerby Mine
5. Onaping Mine
6. Fraser Mine
7. Strathcona Mine
Inco Ltd. Ni, Cu, Pt, Se, Te, Co, Au, Ag, SO2, H2SO4
8. Copper Cliff North Mine
9. Copper Cliff South Mine
10. Creighton Mine
11. Frood Mine
12. Stobie Mine
13. Little Stobie Mine
14. Crean Hill Mine
15. McCreedy West Mine
16. Levack Mine
17. Whistle Mine

Figure 15.2. Producing mines and commodities, Sudbury mining camp.

Stralak Resources Inc.

Stralak Resources Inc. drilled 95 holes having a total length of 10425 m on its property in Craig and Ulster townships in the Benny greenstone belt. The drilling tested the "New East Zone" and the "East Zone". Drill-indicated reserves in the "New East Zone" are as follows: 387000 tons, grading 4.68 percent zinc, 0.73 percent lead, 0.36 percent copper and 2.16 ounces silver per ton. Drill-indicated reserves in the "East Zone" are 216800 tons, grading 5.33 percent zinc, 0.48 percent lead, 0.34 percent copper and 1.05 ounces silver per ton.

Rainbow Exploration Corp.

Rainbow Exploration Corp. holds 132 claims south of Espanola. In 1989, the company purchased control of the McMillan Mine in Mongowin Township, and plans an early drill program to test the "J" zone. Previous owners had dewatered the mine in 1985 and 1986 and had sampled gold-bearing quartz zones underground. The claims cover about 16 km of a narrow belt of gold occurrences.

The company also controls 16 patented claims in central Falconbridge Township, known as the Copper Prince property. Inco Limited optioned the property, and in 1989 completed an induced polarization (IP) survey over the central portion. Four holes with a combined length of 400 m were also drilled on the property. In November, Rainbow Exploration Corp. released results of the drilling. The best copper value intersected was 6.37 percent copper over 0.4 m in hole 79505. The best gold values were 0.461 ounce gold per ton over 0.4 m and 0.196 ounce gold per ton over 0.36 m in hole 79507. Hole 79507 intersected altered breccias (containing up to 80% sulphides) in quartzites.

Placer Dome Inc.

Placer Dome Inc. drilled seven holes having a total length of 717 m on a copper-gold property on claims S960434 and 960473 in Dunlop Township. The property is situated in altered gabbros and Huronian sedimentary rocks. The logs submitted for assessment credit indicate that 104 sections of core were assayed, but the company did not report any metal values. The property was optioned from D. Patrie of the town of Massey.

Sangreal Mining Company Limited

The New Jersey based Sangreal Mining Company Limited carried out surface exploration work on 28 claims in Scadding Township. The claims are held by R. Fielding. The company completed an IP survey on eight claims to better define magnetic and electromagnetic (EM) anomalies obtained in earlier surveys by another company. IP anomalies were trenched and were found to be weathered magnetic mafic dikes. Contrary to earlier expectations, the company did not drill a gold-bearing breccia on Shaw Point.

Augdome Corporation Limited

Augdome Corporation Limited drilled two inclined holes on claim S574962, at the old Gordon mine in Rathbun Township. The combined length of the holes is 215 m. Narrow quartz veins were intersected and the best assay result was 0.013 ounce gold per ton over 0.47 m.

TABLE 15.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Augdome Corp. Ltd.	Diamond Drilling
2	Barry, Donna	Manual
	Barry, Donna	Manual
3	Barry, Harold V.	Manual
4	Brady, John	Manual, Stripping and Diamond Drilling
	Brady, John	Manual, Stripping and Diamond Drilling
	Brady, John	Manual, Stripping and Diamond Drilling
	Brady, John	Manual, Stripping and Diamond Drilling
5	Blue, Peter	Stripping, Trenching and Assaying
6	Boulard, Victor	Stripping and Diamond Drilling
7	B. P. Resources Canada Ltd.	Diamond Drilling
	B. P. Resources Canada Ltd.	Diamond Drilling
	B. P. Resources Canada Ltd.	Diamond Drilling
	B. P. Resources Canada Ltd.	Diamond Drilling
8	Brown, P.A.R.	Geophysics and Geology
9	Canadian Nickel Co. Ltd.	Geophysics and Geology
	Canadian Nickel Co. Ltd.	Geophysics and Geology
	Canadian Nickel Co. Ltd.	Geophysics and Geology
10	Charron, Reginald	Geochemistry
11	Crimsonstar Resources Ltd.	Diamond Drilling
	Crimsonstar Resources Ltd.	Diamond Drilling
12	Durrant, Andrew R.	Geophysics
13	Dyment, Gary	Manual
14	Falconbridge Ltd.	Geophysics, Diamond Drilling and Stripping
	Falconbridge Ltd.	Geophysics, Diamond Drilling and Stripping
15	Fielding, Carman	Stripping, Assaying and Diamond Drilling
16	Fielding, Clifford	Diamond Drilling
17	Fielding, R.J.	Manual and Stripping
18	Flag Resources Ltd.	Diamond Drilling
	Flag Resources Ltd.	Diamond Drilling
19	Gallo Exploration Ltd.	Geophysics
20	Gervais, J.C.	Geophysics, Geochemistry and Stripping
21	G. Hinse Geological Services Ltd.	Geology
22	Goldteck Mines Ltd.	Geophysics
23	Imperial Metals Corp.	Geophysics and Geochemistry
	Imperial Metals Corp.	Geophysics and Geochemistry
	Imperial Metals Corp.	Geophysics and Geochemistry
24	Inco Limited	Geophysics
	Inco Limited	Geophysics
25	Jerome, Edward	Geology, Geophysics, Geochemistry and Diamond Drilling
26	Kerr Addison Mines Ltd.	Geochemistry
27	La Societe De Gestion, Maskours Inc.	Diamond Drilling

TABLE 15.1. CONTINUED.

Number on Figure	Individual or Company	Activity
28	Morrison Minerals Ltd.	Geophysics
29	Naples, Kenneth	Geophysics
30	Noramco Explorations Inc.	Diamond Drilling
31	749494 Ontario Ltd.	Geology
32	Orev[illegible] Inc.	Diamond Drilling
33	Placer Dome Inc.	Geophysics
34	Plexman, Doris	Diamond Drilling
35	Rauhala, Jack	Stripping, Assaying
36	Rivard, Raymond	Diamond Drilling
37	Roy, Bernard J.	Manual
38	Salo, G.R.	Geophysics, Stripping and Assaying
39	Sanftenberg, Morris	Geology
40	Stringer Exploration	Diamond Drilling
41	Stringer, Roger	Geophysics
42	Sudbury Canadian Granite Ltd.	Geology
43	Sungold Resources Inc.	Geophysics
44	Tracanelli, H.J.	Geochemistry, Manual and Stripping
	Tracanelli, H.J.	Geochemistry, Manual and Stripping
	Tracanelli, H.J.	Geochemistry, Manual and Stripping
45	Vanlith, George	Stripping and Manual
46	White, J.W.	Stripping

TABLE 15.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	761	1615	6510	25,255	49,743	8862	104,052
1988	893	1780	7821	21,303	255,824	8746	304,792
1987	5777	720	9358	16,266	43,721	3467	77,041
1986	1191	1171	4396	22,017	14,350	1658	49,820
1985	1079	1297	4358	25,873	56,894	1717	94,541

La Society De Gestion Maskouse Inc.

La Society De Gestion Maskouse Inc. drilled two holes in Tennyson Township, 20 km north of Massey. One hole of 32 m length was drilled on claim S1073104; the other hole (47 m length) was drilled on claim S1073102. The purpose of the drilling was to assess the building stone potential of a mafic dike within Archean granites. The fracture count appears to be too high to allow production of large blocks.

R. Sivard

R. Sivard of Sudbury drilled two holes on claim S943838, each hole with a length of 183 m. The holes are located in the northwestern corner of Norman Township and intersected gneissic granite and amphibolites. Several sections of core were sent for analysis, but no metal values were included in the assessment submission.

J. Owen

In order to assess the building stone potential, J. Owen drilled two short holes (20 m and 30 m) in the southwestern corner of of Nairn Township on a Nipissing diabase sill.

C. Fielding

C. Fielding drilled one 33.5 m deep hole on claim S895160 in Louise Township for assessment work purposes. The hole intersected diabase, metasomatically altered diabase and metaquartzites.

H. Tracanelli

H. Tracanelli holds a six-claim property on each side of Highway 144 in Ulster Township. In 1989, he deepened pre-existing trenches (in places to 5 m). Quartz-carbonate veins found in granite host rock strike at about 060° and are about 30 cm wide on surface. At the bottom of the trenches, the veins widen to twice that measured at surface. In places, the veins contain up to 60 percent sulphides (mostly pyrite and chalcopyrite). Visual estimates indicate that up to 25 percent of total sulphides may be chalcopyrite.

G. Salo

G. Salo continued manual stripping, rock trenching and geophysical surveying, the latter of which was done to fill in earlier magnetic and VLF-EM surveys to include several swamps which are located on his six-claim property in Truman Township. Falconbridge Limited funded mechanical stripping on the property over two key areas; one was a sulphide-bearing zone and the other was a magnetic anomaly. Stripping over the sulphide zone uncovered intermittent pods of sulphides striking east over a 400-foot length. Anomalous copper, nickel, cobalt, and silver values occur with the sulphides. The area may be part of a large breccia unit with massive white vein quartz, carbonate, albite and chlorite alteration. The magnetic zone turned out to be a mafic dike.

RESIDENT GEOLOGIST'S STAFF AND ACTIVITIES

STAFF

Staff working out of the Sudbury Resident Geologist's office in 1989, and their functions, were as follows:

1. P.E. Giblin, Manager, Mineral Resources, Northeastern Region.
2. W. Meyer, Resident Geologist.
3. R.W. Campbell, Staff Geologist. R.W. Campbell resigned his position in April to take a position with the Ministry's Human Resources Branch. The position was not filled again for the rest of the year.
4. T.L. Livingstone, Secretary to the Manager, Mineral Resources, and part-time secretary to the Resident Geologist.
5. L.B. Jerome worked as a contract geologist funded by COMDA on Geological Data Inventory Folios (GDIFs).
6. B.I. Gates worked as a contract geologist funded by COMDA on the Sudbury Mineral Occurrence Study. A summary of this work is included in this report.
7. J.K. Lacey continued to work (funded by COMDA) on the Sudbury Building Stone Study. J.K. Lacey completed an open file report (Lacey 1989) on his 1988 work. A summary of this year's work is included in this report.
8. R.J. Henri, who's contract was also funded by COMDA, assisted B.I. Gates with field and office work.
9. M. Scorethorne joined the staff for the summer months as an assistant to J.K. Lacey. This was made possible by the Experience '89 program.

ACTIVITIES

Staff of the Resident Geologist's office responded to about 600 enquiries regarding assessment work, the geology of the area, mineral occurrences, mineral potential, conceptual ideas, government programs, and rock and mineral identification. Staff visited properties, discussed problems with property owners in the office and in the field. The staff were also involved in land use planning issues.

In addition, staff were asked to guide tours, give talks on a variety of topics to diverse audiences and to participate with displays at several public functions. Only a few of these activities are described.

In February, staff participated with a sample and poster display at the Regional Mines and Minerals Symposium in Timmins, showing results of the two COMDA-funded studies. R.W. Campbell gave a talk on building stone.

In March, and again in November, W. Meyer gave talks to students and faculty in the Geology Departments at the University of Windsor, Lakehead University in Thunder Bay, and Laurentian University in Sudbury. This was sponsored under the Canadian Institute of Mining and Metallurgy (CIM) Visiting Lecturers Program. The topic chosen was "Planet Earth: yesterday, today and tomorrow", which put the present-day environmental debate in the context of Earth history. In October, the same talk was given to the local branch of the CIM in Haileybury.

In April and May of 1989, the Resident Geologist's office arranged 18 hours of prospector classes stretching over six evenings. The first 50 people to register were accepted. Twenty-eight people attended at least five evenings. Cambrian College made a classroom available at no cost. Four Cambrian College staff members volunteered their time to talk to the class about their field of expertise. The four were: T. Jones, J. Filo, R. Johnson and F. Charlton. Staff from the mining companies who also taught a session were: W. Peredery, Inco Limited and G. McTaggart, Falconbridge Limited. Ministry staff who assisted with the classes were: V. Miller, J.K. Lacey, R.W. Campbell and B. Gates. T. Livingstone handled the administrative load. The Resident Geologist wishes to acknowledge the help of those named, all of whom contributed to the success of the course.

In May, the office participated in a joint Northern Development–Mines and Minerals Division display at the Manitoulin Trade Fair in Little Current. The Mines and Minerals display, prepared and looked after by J.K. Lacey, featured Manitoulin Island stone for use as aggregate and as building stone.

In July, W. Meyer accompanied two visitors from the Korean Mining Promotion Company on visits to Falconbridge operations in Sudbury and Rio Algom operations at the Stanleigh mine in Elliot Lake. The visitors, guests of the Ministry of Industry, Trade and Technology, were on a fact-finding tour looking for investment opportunities in base metals and uranium mining. The goal was to eventually secure long-term supplies at negotiated prices for their industries.

In July, the Mines and Minerals Division participated in the 6th Annual Sudbury Gem and Mineral Show. J. Webb from the Geoscience Information Office of the Ontario Geological Survey, Toronto, displayed Ministry publications and J.K. Lacey from this office displayed maps and samples showing the building stone potential of the district.

In late August, all staff were involved with the 46th Annual Mines Ministers Conference, held in Sudbury.

On September 27, R. Henri and W. Meyer took a group of geography teachers on a Ministry-sponsored one hour aerial tour of the Sudbury mining areas. This has been an annual event for several years. The tour is organized by B. Campbell of the Ontario Mining Association. Each year it offers 35 to 40 geography teachers, primarily from southern Ontario, the opportunity to visit northern Ontario mining communities for one week. The Ministry's contribution is the aerial tour, which gives an overview of all the mining activity in the area. The feedback has been good every year. The teachers go home with a better understanding of northern Ontario, particularly the role mining plays here, and can pass on their experiences to their students. Over the years, close to 500 teachers have made the trip.

Through the year J.K. Lacey led several groups of interested persons from government and the private sector on tours of the district's potential building stone sites and existing quarries. As well, J.K. Lacey went on several educational trips outside the Sudbury District to see building stone activity in other parts of the province.

P.E. Giblin and W. Meyer attended several planning meetings during the year to discuss a Lithoprobe seismic survey and a deep drill hole for the Sudbury structure.

PROJECTS

SUDBURY MINERAL OCCURRENCE STUDY

by B.I. Gates

This was the third year of a project funded by the Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario. The purpose of this project is to gain a better understanding of mineral occurrences northeast of Sudbury and thereby assist private sector exploration to locate new mineral deposits. Various properties were looked at within ten townships. As in the two previous summers, the majority of the occurences are gold or gold-copper showings related to soda metasomatism. Assistance was provided by R.J. Henri.

The area is underlain by sedimentary rocks of the Huronian Supergroup and is intruded by Nipissing diabase sills, dikes and irregular bodies. Nickel-copper-platinum group element occurrences associated with the diabase appear to be limited in extent. Several gold-bearing quartz veins, located in diabase, are associated with a prominent carbonate-rich halo. At least one quartz vein has a 2 m zone of albitized diabase along the footwall.

Most gold showings occur in soda-metasomatized sedimentary rocks. The albite alteration can range from incipient to complete replacement. The albite is often tan to pink in colour due to very fine grained inclusions which are most often hematite dust. This offers the prospector an easily recognizable target worth investigating. Other styles are not as readily recognizable. In Lorrain Formation sedimentary rocks, the sericitic matrix that gives the typical quartzites their green colour is replaced by albite. The resultant pink rock closely resembles an arkose. Gowganda Formation wacke, which is typically dirty grey, can be altered to a fine-grained, light-greenish rock containing relic quartz grains. The quartz is the last mineral replaced. The resultant rock is very easily mistaken for a quartzite unit within the Gowganda sequence.

Secondary features often associated with soda metasomatism may give a clue to the origin of the occurrence. Calcium–magnesium–iron carbonate rhombohedra occur with albite alteration and develop well into the enclosing rocks, which appear otherwise unaltered. The rocks may be brecciated or sheared. Carbonate rhombs may in turn be replaced by chlorite, quartz or sulphides. Secondary chemical events include: quartz flooding, chlorite formation, carbonatization and the introduction of sulphides, hematite and gold. Narrow quartz veins which cut the alteration may contain galena, pyrite, chalcopyrite and gold. These late quartz veins may represent silica leached from the host rocks by the metasomatic fluids. The sulphides are commonly pyrite, chalcopyrite, arsenopyrite and pyrrhotite. There is no direct correlation between sulphide content and gold values, however, some sulphides must be present. Free gold was most often noted with drusy quartz, which is often associated with hematite.

In 1989, a close association between mineral occurrences and Sudbury breccia became evident. Eleven showings related to albite metasomatism had Sudbury breccia spatially related to them. Thirteen showings of Sudbury breccia, in whole or in part, are replaced by albite or contain carbonate rhombohedra. Two other Sudbury breccias are cut by gold-bearing quartz veins with their associated chlorite alteration. The significance of this close association is unknown. The metasomatic fluids may have exploited the Sudbury breccia as only a pre-existing weakness. Another possibility is that the two features are directly related, in which case the same process which formed the Sudbury breccia later became the source for the soda-rich fluids. Their frequency of distribution appears to centre on the Sudbury structure, however, this may only be a reflection of our present coverage.

Southwest of Sudbury, several areas of soda alteration, which do not occur with Sudbury breccia, are spatially related to strong regional faults.

Two albite alteration zones are known to occur within rocks of the Grenville Front tectonic zone. This may represent remobilized albite from previously altered Huronian rocks or indicate that soda metasomatism extended over a considerable time span.

Wolf Lake

This property in Mackelcan Township is located along the west shore of Wolf Lake (UTM coordinates 527900E, 5188900N). The first work on the property was probably done by The Mountain Mining Co. of Ontario in 1898, with the property subsequently surveyed as WD77. Since 1981, considerable work has been done in the area by both Flag Resources (1985) Limited and Hecla Mining Company of Canada Limited. The main showings were mapped at 1:500 scale over a 300 m square grid.

Wolf Lake is located near the southern end of a large trough-like structure of Lorrain Formation sedimentary rocks. The area is rugged and has a maximum relief at about 250 m. It is underlain by a distinct green arkosic quartzite, with local thin paraconglomerate beds. It is a massive, to bedded, sandy unit with a 15 to 25 percent sericitic matrix, which gives the rock its characteristic green colour. Sudbury breccia is common, occurring most often along the strong linears which are prominent throughout the area.

Surface showings are limited in extent. Mineralization occurs in pink quartzite breccia having a quartz matrix. The mineralization contains iron oxides, pyrite, chalcopyrite, covellite and gold. The alteration from green to pink quartzite involves the loss of K_2O (3.95 to 0.26%), the introduction of Na_2O (0.01 to 4.20%) and the introduction of SiO_2 (80.6 to 85.3%). Quartz is added and the sericitic matrix has been replaced by albite. Chlorite breccia zones, both barren and pyritic, have also been intersected in diamond-drill holes. The pink quartzite breccia appears to occur entirely within larger occurrences of Sudbury breccia.

The largest of the five known mineralized zones is the "No. 3 Zone" which appears to occur at the junction of two linears. The northeast linear contains a narrow diabase dike which appears to be offset by the pink quartzite breccias along the northerly trend. Mineralized pink quartzite breccia forms a cap on Sudbury-brecciated Lorrain quartzite, which outcrops along the shoreline of Wolf Lake, and plunges about 30° east beneath the lake. This zone failed to respond to IP, VLF-EM, and ground magnetometer surveys.

In excess of 50000 feet of diamond drilling has been carried out since 1981. Despite good gold and copper values over acceptable widths, the erratic nature of the mineralization has made it impossible to outline an economic reserve. Five vertical holes were drilled (maximum depth of 325 m) beneath the lake in 1985, several of which ended in pink quartzite breccia. The nature of any vertical zoning is unknown, but as the metasomatic fluids appear to be deep seated in origin, the ore potential at depth remains untested.

Parkin Township Calcite

Recent stripping has uncovered a body of calcite enclosed within Huronian sedimentary rocks. It is located in south-central Parkin Township at the northwest corner of McFie Lake (UTM coodinates 507850E, 5186600N). Diamond drilling has also encountered massive sulphides associated with the calcite. The showing was mapped at 1:250 scale and several control lines were mapped at 1:1000 scale for local geology.

The area around the Parkin Township calcite occurrence is gently rolling and has an extensive but shallow drift cover. Mississagi Formation quartzites are typically grey-white, massive, with occasional narrow interbedded pelitic units. The unit strikes 310° to 315° and dips 70° southwest.

The Mississagi Formation is conformably overlain by Bruce Formation paraconglomerate. The Bruce Formation paraconglomerate contains 10 to 40 percent fragments within a greywacke matrix. Nipissing diabase, trending about 300°, crosscuts these two units. Sudbury breccia is common along the contact between the diabase and the sedimentary rocks and is common along the Mississagi–Bruce contact. The geology becomes confusing away from the lower contact of the diabase. Numerous large blocks (up to 30 m in maximum dimension) of Espanola Formation limestone, Bruce Formation paraconglomerate and possible Serpent Formation arkose occur within the diabase. These blocks have varying strikes and are located out of their normal stratigraphic positions. Another peculiar feature is a "streamer breccia" which cuts both sedimentary rocks and diabase and is most often associated with the sedimentary clasts within the diabase. The "streamer breccia" is known to strike northwest with a length of over 5 km (approximately) and a width of up to 700 m. The "streamer breccia" consists of angular to subrounded clasts of all sizes (up to several metres across) and includes Bruce Formation and Espanola Formation paraconglomerates, quartzites, siltstones, wackes and diabase. It may also contain albitized clasts or the breccia may be partly albitized. It generally has a bleached appearance on outcrop surfaces.

The following scenario may explain the features described above: hydrothermal fluids rose from depth and albitized a large zone and choked the fluid channels; explosive brecciation injected both the metasomatized clasts and unaltered clasts into the shattered rocks above; continuing rising solutions altered some of the breccia (W. Meyer, Ministry of Northern Development and Mines, personal communication, 1989). The large clasts of dislocated sedimentary rocks within the diabase may have been carried up by the "streamer breccia".

The calcite body is located along the trend of the southwestern contact of the diabase. The diabase contact has been locally dislocated and the calcite deposit is enclosed by carbonatized rocks of Bruce Formation.

The body is about 30 metres square on surface, extends to a depth of 35 m and has an apparent dip to the northwest. Only the northeast corner or about 20 percent of the exposed deposit is white calcite. The remainder contains up to 15 percent fine-grained, brownish-grey dolomite rhombs along cleavage planes. Average of two analyses of the calcite was 55 percent CaO; 1.70 percent SiO_2; 0.12 percent Fe_2O_3; 0.40 percent MgO. Based on diamond drilling in 1986, Raretech Minerals Inc. estimated the body to contain 25760 tons of calcite and 121700 tons of mixed calcite and dolomite.

One interesting feature discovered by diamond drilling is the presence of massive and stringer sulphides along the calcite–wall rock contacts in one hole and along fractures within the calcite body in another hole. The widest intersection is 4.5 m (13.6 feet) of pyrrhotite, chalcopyrite and pyrite along the hanging wall contact. Best assay values are 0.56 percent Cu; 0.019 percent Ni and 0.066 percent Co.

The origin of this calcite body remains a mystery. Calcite was noted elsewhere as fracture-fillings in diabase and in Espanola Formation limestone clasts. Within one limestone clast, a core of calcite was rimmed by albitized limestone. The calcite may have originated from the Espanola Formation and underwent remobilization caused by the diabase intrusion or it may have been leached by metasomatic fluids occurring later.

SUDBURY BUILDING STONE STUDY

by J.K. Lacey

Field work was completed in 1989 for the second year of this two year program to assess the "granite" building stone potential of the Sudbury area. The project is funded under COMDA Project D.4.1. The intent of this project is to outline high-potential building stone areas based on the joint density, colour and mineralogy of the rock and to encourage exploration and possible development of these sites.

The 1989 field investigations consisted mainly of reconnaissance-scale mapping of a large area west and northwest of the Sudbury Basin. The area comprises approximately 30 townships and has good access due to an extensive network of logging roads which extend north from Highway 17, west of the villages of Massey and Webbwood (*see* Figure 15.1). The area is underlain predominantly by early Precambrian pink to grey granitic rocks, gneisses, metavolcanic rocks and large mafic intrusions centred in Boon and Dunlop townships. The overall potential of the examined area is poor for the development of granite quarries. In most areas, blocky jointing exists as joint spacing averages 1 m. Very few areas have the consistent colour or texture needed to quarry uniformly large size blocks.

Exploration and development of granite deposits in the Sudbury area continued at a strong pace in 1989. Three quarries produced granite in 1989, they are: "Dana Black Granite" (Canadian Shield Quarries Ltd.); "Positano Granite" (Poscan Ltd.) and "Killarney Tweed" (Canadian Unique Granites Ltd.). Canadian Shield Quarries Ltd. produced rough blocks from January to November 1989, for shipment to fabricating plants in Quebec. "Killarney Tweed" and "Positano Granite" were produced on a limited basis for promotional products in hope of securing sales in 1990. Exploration continued at six sites throughout the region, with blocks extracted from each site for preliminary testing such as cutting and polishing, physical-property testing and market evaluation.

Many general inquiries about the building stone industry were answered and tours were arranged for interested parties to see operating quarries and high potential areas as outlined in Lacey (1989).

Study tours to other stone-producing areas included the quartz and muscovitic gneiss deposits in McAusland and Poitras townships, located northeast of North Bay; the Kingston area granite quarries and the limestone and/or marble quarries in the Lower Bruce Peninsula.

Polished samples of building stone from producing quarries and from high potential areas have been made for public viewing at the Sudbury Resident Geologist's office.

The following are brief descriptions of the production, advanced development, and exploration of granite deposits in the Sudbury area.

Canadian Shield Quarries Ltd. (Vior–Mazarin Group) produced "Black Granite" from a quarry located in south-central Dana Township, 9 km northwest of River Valley. The quarry was formerly operated by C. Larcher of Dana Black Granite Ltd.

This deposit is a massive, medium- to coarse-grained, black anorthosite with irregular joint spacing. Production in 1989 (January to November) is estimated at 640 m³ (22500 cubic feet). All production material is shipped as rough blocks to fabrication plants in Quebec and Japan (D. Chalifoux, Canadian Shield Quarries Ltd., personal communication, 1989).

Poscan Ltd. continued to operate a quarry in central Henry Township, 65 km east of Sudbury, producing "Positano Granite"—a black and white, gneissic- to mottled-textured, gabbroic anorthosite. A limited amount of quarrying in the spring of 1989 produced a stock pile for the production of promotional products for an active advertising campaign in Canada and the United States. Poscan plans to go into production in 1990.

Canadian Unique Granite Limited operated a quarry in the southeast corner of Goschen Township, 35 km northeast of the village of Killarney. There was some quarry activity in 1989. The colourful pink and black porphyritic granite, marketed under the name of "Killarney Tweed", is being promoted to generate interest. The company is currently seeking investors to help develop the property.

Khouri Granite Limited began full operation of its fabricating plant in January 1989. Located in Sudbury, the plant produces such items as counter tops, flooring tiles, hearths, monuments and building cladding. The facility uses both precut slabs and rough quarry blocks of granite and marble up to a maximum weight of 15 tonnes. The plant is equipped with automatic and semiautomatic polishers, circular diamond saws and a diamond wire saw for sawing large pieces. Khouri Granite Limited is also performing an important role in local development by test cutting and polishing stone from local sources.

Norgranite Company Limited, a local company, continued investigation of three building stone prospects in the Sudbury area. This was the second year of their exploration program to assess the potential of these prospects, the three are: the Pure Lake prospect which is a coarse-grained, brown to salmon pink monzonite; the Chartrande Farm prospect which is a brown to pink, highly varying, gneiss monzonite; the St. Charles prospect which is a a coarse-grained, black and white anorthosite (*see* Figure 15.1).

Preliminary evaluation of these prospects consisted of stripping and washing of outcrops in preparation for the extraction of test blocks. In the fall of 1989, test blocks were shipped to Khouri Granite Limited in Sudbury to be cut and polished for market evaluation.

J. Owen continued to evaluate his Nipissing diabase "Black Granite" property in Nairn and Baldwin townships, 35 km southwest of Sudbury. Exploration work in 1989 consisted of stripping, diamond drilling and extracting of test blocks to be cut and polished.

Sudbury Canadian Granite Ltd. is evaluating its fine-grained gabbro property in Cadeau and Tennyson townships. A diamond-drill program in May and June 1989 was designed to test joint density and outline fracture-free zones.

Blue Mountain Granite Ltd., a new Sudbury-based company, is exploring two sites in the Killarney area south of Sudbury. Located within 3 km of the Killarney–Tweed quarry, both sites have low-density jointing with joints spaced 1 to 3 m apart. This will allow the extraction of commercial size blocks. Exploration consisted of extensive stripping and extracting of test blocks. The stone at one site is a massive, pink and black, feldspar porphyry and the second is a gneissic, red and black, medium-grained granite. All sites are located within the Killarney granite, part of a large batholithic complex of felsic intrusive rocks located along the Grenville Front tectonic zone. The extracted blocks have been shipped to Italy for testing on automatic cutting and polishing equipment.

GEOLOGICAL DATA INVENTORY FOLIOS

by L.B. Jerome

The Geological Data Inventory Folio (GDIF) program was funded by COMDA under Project A.4.6. Fifteen GDIFs that had been prepared in 1988 were published in 1989.

In 1989, 10 other GDIFs were completed and were awaiting publication. Three other GDIFs were in preparation at year end.

Davis Township (GDIF 353) was completely redone in late 1989. The base map used to create this GDIF was from the Ontario Base Map (OBM) G-Plan series at a scale of 1:20000. Most of the content for this GDIF was recalled and printed from a GDIF computer data base. This development allows new material to be updated as it comes in.

LITHOPROBE AND CANADIAN CONTINENTAL DRILLING PROGRAM

Several meetings were held in Sudbury to plan a LITHOPROBE seismic reflection survey of the Sudbury structure. A local Lithoprobe Steering Committee was formed, with A.J. Naldrett of the University of Toronto as Chairman. The survey will likely be carried out in 1991, and should help in deciding where to drill a deep hole in the Sudbury structure.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

M.E. Avermann and V. Mueller-Mohr, graduate students, University of Muenster, Federal Republic of Germany, continued summer work on breccias in the footwall of the Sudbury Igneous Complex and the overlying Onaping Formation. The program is of a co-operative nature between the university and the Ontario Geological Survey.

RESEARCH BY OTHER AGENCIES

Three projects, funded under the Ontario Geoscience Research Grant Program, fall wholly or in part within the Sudbury District; they are:

1. A.J. Naldrett and C. Li of the University of Toronto continued with their study *Platinum group elements in the footwall at Sudbury*.
2. M. Coniglio and M.C. Byerley of the University of Waterloo continued to work on *The sedimentology and correlation of the Upper Ordovician Georgian Bay Formation, Manitoulin Island and Bruce Peninsula*.
3. W.S. Fyfe and T.J. Beveridge of the University of Western Ontario were in their first year of a study entitled *Geochemistry of aquatic biofilms and bacterial mineralization*.

ONTARIO MINERAL EXPLORATION PROGRAM (OMEP)

In 1989, 11 companies and individuals received last payments totalling $232709 under the Ontario Mineral Exploration Program, which was phased out on December 31, 1988. All payments were for projects started before that date. None of the projects appear to have carried over into 1989.

SELECTED PUBLICATIONS RECEIVED

The Sudbury Resident Geologist's office usually has the most recent issues of the following periodicals available:

The Northern Miner, Northern Miner Magazine, CIM Bulletin, Economic Geology, Geotimes, GEOS, Mining Journal, Mining Magazine, Mining Engineering and *Canadian Mining Journal*.

Listed below are some of the books received by the office in 1989. The books bear thematically upon the district directly and indirectly, and on mining and exploration in general. Books and periodicals are available to the interested reader for viewing at the office.

Bursnall, J.T. 1989. Mineralization and shear zones; Geological Association of Canada, Short Course Notes, v.6, 299p.

Coombes, J.S. 1989. Platinum, 1989 interim review; Johnson Matthey Public Company Limited, 24p.

Garland, G.D. 1989. Proceedings of exploration '87, third decennial international conference on geophysical and geochemical exploration for minerals and groundwater; Ontario Geological Survey, Special Volume 3, 914p.

Harris, D.C. 1989. The mineralogy and geochemistry of the Hemlo gold deposit, Ontario; Geological Survey of Canada, Economic Geology Report 38, 88p.

Ho, S.E. and Groves, D.I. 1988. Advances in understanding Precambrian gold deposits, volume II; Geology Department and University Extension, University of Western Australia, Publication No.12, 360p.

Lacey, J.K. 1989. Building stone inventory of the Sudbury Resident Geologist's area; Ontario Geological Survey, Open File Report 5721, 64p.

MacKenzie, B., Bilodeau, M. and Doggett, M. 1989. Mineral exploration and mine development potential in Ontario: economic guidelines for government policy; Centre for Resource Studies, Queen's University, Kingston, Technical Paper No.9, 180p.

Shadmon, A. 1989. STONE, an introduction; Intermediate Technology Publications Ltd., London, 140p.

REFERENCE

Lacey, J.K. 1989. Building stone inventory of the Sudbury Resident Geologist's area; Ontario Geological Survey, Open File Report 5721, 64p.

16. Southern Region Introduction

A.E. Pitts

Regional Manager, Southern Ontario Region.

During 1989, mineral production values in Southern Ontario were approximately $1.7 billion. The region is the main source for Ontario's structural materials such as sand, gravel, crushed stone, clay, shale, calcined lime and building stone; and for its industrial minerals such as salt, gypsum, nepheline syenite, talc, silica and gemstones. Exploration has continued at a high level, with interest in graphite, platinum, gold, quartz, building stone, dolomite and wollastonite being the most sought commodities.

Again, this year, the focus of exploration activity in the region has been graphite. Cal Graphite Corporation has almost completed construction of their mill in Butt Township and are expected to bring their graphite deposit into production in early 1990.

Stewart Lake Resources Incorporated announced a production decision in October and are now seeking financing and approvals in order to commence development of their graphite deposit on Desert Lake in Bedford Township.

North Coast Industries Limited have completed a feasibility study of their graphite property in Maria Township and are in the process of making a production decision.

The Southern Ontario Region has three Resident Geologists' offices, located in London, Dorset and Tweed. Resident Geologists provide a professional advisory service on the geology and mining activity in their districts. They also offer assistance in local resource development and provide advice on land hazards and land-use planning. In November, a new office was opened in Tweed. This is located on the Old Troy Road and should provide a better facility for eastern Ontario clients.

The Southern Ontario Region also has an office in Bancroft which is managed by H. Meyn, who is a Regional Specialist. In 1989, H. Meyn did some detailed mapping and mineral deposit studies of the Queensborough syncline located in Madoc Township. An open file report of this work should be available in 1990. The Bancroft office also provides advice on local geology, mineral collecting and mining activities.

The Southern Ontario Region has two Drill Core Libraries which are located in Tweed and Bancroft. Relevant drill core reference material is obtained from mineral exploration programs in the area and is logged and indexed for ready access by clients.

The five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, will be finished this year. Projects on building stone, industrial minerals and refractory minerals are in the final stages of completion and are described in more detail in the following reports.

17. Algonquin Resident Geologist's District—1989

M.I. Garland[1], D.J. Villard[2] and C. Marmont[3]

[1]Staff Geologist, Algonquin Resident Geologist's Office, Southern Ontario Region.

[2]Resident Geologist, Algonquin Resident Geologist's Office, Southern Ontario Region.

[3]Geologist, Algonquin Resident Geologist's Office, Southern Ontario Region.

INTRODUCTION

Exploration in the Algonquin District continued in 1989 with special interest in graphite, platinum group and precious metals, and building stone. Cal Graphite Corporation continued developmental work on the mine and mill buildings in Butt Township throughout 1989, and expects to be in production early in 1990. North Coast Industries Limited have completed a feasibility study on their graphite deposit in Maria Township and are in the process of making a production decision.

The four-year program, funded under the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario, is in the final year. Work concentrated on the final checking of suitable building stone prospects and extracting test blocks for tile and thin veneer production.

Exploration for platinum group and precious metals, vanadium, flagstone, as well as, other industrial minerals was the main activity by mining companies and prospectors in 1989.

Public education continues to be an important function of the office, as the Ministry of Northern Development and Mines again funded a significant part of the minerals program at the Leslie M. Frost Natural Resources Centre. Specialized mineral programs were given to provincial parks throughout all of southern Ontario, school groups in Muskoka and Haliburton, and various service clubs.

MINING ACTIVITY

Producing mines in the district at present include several stone and quartz quarries. The most notable stone producers are the Mill Lake Quarry at Parry Sound and Central Ontario Natural Stone Limited, both of which produce flagstone, and Rama Stone Quarries Limited in Rama Township which produces dimension stone. Several other smaller quarries produce stone on demand. A quartz quarry in McClintock Township is worked on an intermittent basis, the crushed quartz product being sold for various decorative uses.

ADVANCED EXPLORATION AND DEVELOPMENT

Cal Graphite Corporation

During 1989, development work on the Cal Graphite deposit continued at a steady rate. At the time of writing, it is expected that the deposit will be in production early in 1990. In terms of development, the actual deposit is ready for the independent mining contractors who will be able to move in on 10 days' notice; all of the drainage containment facilities are in place and the mill is in the final stages of construction. Initial plans call for a mill rate of 3000 tonnes per day, increasing to 5000 tonnes per day within three years. Once the deposit is in production, significant effort will be directed towards bringing on line their leaching plant in Walden. The company feels that this facility will provide an economical upgrading of graphite flake to levels of high purity for the development of new products.

North Coast Industries Limited

North Coast Industries Limited have completed a feasibility study on their graphite property in Maria Township, and are in the process of making a production decision. The company is apparently looking for a partner to help finance the development.

EXPLORATION ACTIVITY

As of November 1989, a total of 121 claims had been staked in the Algonquin Resident Geologist's District. Exploration activity concentrated on interests in platinum group and precious metals, vanadium, building stone, quartz, graphite, flagstone and dimension stone, mafic rock for mineral wool, and amethyst for metaphysical purposes.

PLATINUM GROUP AND PRECIOUS METALS

A total of 68 claims were staked in McClintock Township, over parts of a mafic to ultramafic unit. Several different prospecting groups are involved in independent exploration programs. Exploration to date consists of cutting lines, prospecting, some geological mapping, and an airborne magnetometer and very low frequency electromagnetic (VLF-EM) survey.

A nickel-copper occurrence in Brunel Township, near Otter Lake, is still being prospected for nickel,

TABLE 17.1. EXPLORATION ACTIVITY DURING THE YEAR.

Number on Figure	Individual or Company	Activity
1	Cal Graphite Corporation	Developmental work on mine site, Butt Township
2	Northcoast Industries Limited	Feasibility Study, Maria Township
3	Ellerington, William C., et al.	Prospecting, line cutting, sampling, airborne geophysics, McClintock Township
4	Vihonen, B.	Prospecting, McClintock Township
5	Irving, J.	Prospecting, sampling, Brunel Township
6	Premier Explorations	Sampling, Papineau Township
7	Wickern, B.	Prospecting, Ryerson Township
8	Perron, P.	Diamond drilling, Boulter Township
9	McBride, R.	Granite evaluation, Strong Township
10	Jones, F.	Staking, McClintock Township
11	Jones, E.	Prospecting, Lount Township

TABLE 17.2. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDIT.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Total Man Days
1989	121	218	485	202	9,280	240	9,722

platinum group and precious metals. Work this year consisted of prospecting and rock sampling.

GOLD

Limited exploration for gold by local prospectors continued within the Algonquin Resident Geologist's District, in McClintock, Ryerson and Brunel townships.

VANADIUM-TITANIUM-MAGNETITE

Premier Explorations Incorporated have six claims over a vanadium-bearing magnetite occurrence in Papineau Township, concessions V and VI, lots 16 to 18. Past work has consisted of geological mapping, stripping, and airborne magnetometer and VLF-EM surveys. Work this year consisted of additional rock sampling.

QUARTZ

There has been continued interest expressed by local prospectors in the many, small but pure, quartz veins found throughout the district. One of these quartz veins, located in McClintock Township, Concession VI, lots 23 and 24, is quarried on an on-demand basis. There is also interest in amethyst; prospecting for this mineral has begun in the northwestern part of the Algonquin Resident Geologist's District.

STONE

Several companies have been active in the Huntsville area in their search for a good supply of gneissic flagstone. Also, as a result of an interim report on building stone opportunities in central Ontario released in May 1989 (Ministry of Northern Development and Mines 1989), several companies have been active in the area looking for good sources of architectural stone.

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

The office is currently staffed by D. Villard, Resident Geologist; M.I. Garland, Staff Geologist; J. Reed, Secretary; and C. Marmont, Contract Geologist.

A significant amount of the Resident Geologist's time has been spent working with Cal Graphite Corporation, together with the Ministry of Natural Resources and the Ministry of the Environment, co-ordinating the development process for the mine and for arranging funding assistance. As in previous years, the rest of the Resident Geologist's time was spent on consultative duties, with requests for information or assistance coming from individuals and companies engaged in mineral exploration or development in the Algonquin Resident Geologist's District. The Resident Geologist has also been active on some provincial committees, including one regarding the new Mining Act and one dealing with the development of guidelines for the production of mineral-potential maps.

The Staff Geologist has been continuing field studies in the Parry Sound area, concentrating on the economic potential of mafic rocks in the Parry Sound Domain, and has been field checking all active exploration properties in the Algonquin Resident Geologist's District.

The Staff Geologist was heavily involved with mineral sessions at the Leslie M. Frost Natural Resources Centre, as well as, participating on the Timber Management Committee for the Timber Management Plan, along with the Resident Geologist. The Staff Geologist's alter ego, known as "Prospector Pete", conducted 13 mineral shows and evening talks at provincial parks across southern Ontario. "Prospector Pete" was also responsible for conducting a session on gold panning to the general public at the Leslie M. Frost Natural Resources Centre, and for contributing to the Ministry of Northern Development and Mines' display at Ontario Place in Toronto this year. Several talks on various aspects of mining were given, as well as mineral sessions to schools and to Junior Rangers. The Staff Geologist, Resident Geologist and Contract Geologist acted as judges at several science fairs held in the district.

The Contract Geologist continued with the final year of a four-year study, funded by COMDA. Field work on building stone focussed on banded granites (orthogneiss) and on flagstone, and included roadside reconnaissance surveys in the eastern half of the Algonquin Resident Geologist's District. Detailed follow-up surveys were conducted in those areas showing greater potential, as was determined by the previous year's work. Two publications were released in 1989; one an open file report (Fouts and Marmont 1989), the other an interim report on building stone opportunities (Ministry of Northern Development and Mines 1989).

Both the Contract Geologist and the Staff Geologist presented talks at the Ontario Mines and Minerals Symposium held in Toronto, in December of 1989.

PROPERTY EXAMINATIONS

Armour Township Copper-Nickel Occurrence

Satterly makes reference to the old Nickel Cliff Mine, Lot 17, Concession VIII, Armour Township (Satterly 1943). In 1900 and 1901, a shaft was put down 10 m with a drift extending 7 m to the south. The old mine is located approximately 5 km east of Burk's Falls, near Kernick Lake. The deposit was included in a study on gold in the Algonquin Resident Geologist's District (Villard et al. 1984) and was the subject of a BSc thesis (Keevil 1976). The pit itself is located on the south side of a hill, approximately 200 m north of Kernick Lake, and 220 m west of a township road branching off Concession Road VII. The property is privately owned.

Three rock types were identified in the vicinity of the pit: a black, massive metagabbro, with varying amounts of sulphides and magnetite; a hornblende-biotite-garnet gneiss; and a quartz-plagioclase-biotite schist. Overall strike of the schistose and gneissic rocks is easterly, with dips of 60° to 70°S. Mineralization consists of disseminated pyrite-pyrrhotite-chalcopyrite in amounts up to but usually less than 2 percent. Sulphide mineralization occurs in a band along the south edge of the metagabbro. Magnetite was noted in exposures of gabbro to the north.

The metagabbro consists of clinopyroxene, orthopyroxene, hornblende, plagioclase and garnet. The rock is usually massive, except towards the contact with the hornblende-biotite-garnet gneiss, where it becomes finer grained and schistose. Under a polarizing microscope, the orthopyroxenes are very pleochroic and appear to be metamorphic. The garnets form coronas around the plagioclase. The hornblende-biotite-garnet gneiss varies from a gneissic gabbro to a black and white quartz-plagioclase-hornblende gneiss. This unit occurs between the metagabbro and the pink, sugary-textured, quartz-plagioclase schist to the south, and may be the sheared contact of the gabbro. Samples from the Nickel Cliff Mine's dump ran 0.1 percent Cu, 15 ppb Au and 0.1 ppm Ag (Villard et al. 1984).

McClintock Township Nickel Occurrence

Originally considered for nickel, this occurrence is now being explored for the platinum group metal potential associated with nickel deposits, as well as for the base and precious metal potential. The host rocks to the mineralization are mafic to ultramafic gabbro, pyroxenite and peridotite. Airborne magnetic and electromagnetic surveys flown in 1988 revealed conductors not tested by previous exploration programs.

The original showings are in concessions IX to XI, lots 17 and 18, and consist of sulphides (pyrrhotite, pyrite and minor chalcopyrite) in massive, coarse-grained, pyroxenitic rock. Mafic to ultramafic rock outcrops throughout the entire central region of the township, and contain, in places, disseminated sulphides. The strike of the surrounding gneissic units is southwest, with dips that are gentle to the east. The mafic rocks are usually massive, becoming finer grained and more gneissic towards the contact with the gneisses. The mafic rocks are sandwiched between gneissic units, and appear to be structurally concordant with them.

Brunel Township Copper-Nickel Occurrence

This occurrence consists of a pit and a shaft, located in Lot 22, Concession XI, Brunel Township. The development work took place about 30 years ago. Access is via a tractor trail, exiting from Brown's Road at a point approximately 4 km east of Brunel Road. The shaft is almost a kilometre from Brown's Road. The surface and mineral rights are privately owned, and attempts have been made to option the property.

The rocks in the pit look gabbroic on the weathered surface. They are massive and coarse grained. Towards the bottom of the pit, the rock is very dark, with large pyroxene crystals visible in hand sample, and containing up to 5 percent sulphides. Apparently, samples from this pit ran 5 percent nickel (J. Irving, personal communication, 1989). Rocks in the shaft, which is 100 m west of the pit, are very rusty and schistose. The strike is easterly, with dips of 45°S. Apparently, Inco Limited looked at this occurrence and found that the ultramafic rock was very irregular in dimension along strike and downdip. It is quite possible that the mafic rocks occur as boudins within the surrounding gneisses.

Maria Township Graphite

North Coast Industries Ltd., in partnership with Princeton Resources Corporation, are continuing work on the graphite deposit in Maria Township, Concession 3, lots 18 to 28; Concession 4, lots 19 to 28; Concession 5, lots 19 to 25; Concession 6, lots 19 to 23; and Concession 7, lots 19 to 22. The pilot mill has been removed from the site. The trench from which the bulk sample was removed is approximately 100 m long and up to 5 m deep, and 4 m wide. The graphite unit extended for the full depth of the trench, dipping very gently to the south. The rock is a grey, finely banded quartz-feldspar-graphite gneiss.

The deposit has established proven and probable reserves of 20 million tonnes (t) flake graphite, which has an average grade of 3.18 weight percent. Production rate at the mill is expected to be between 16000 and 20000 tonnes per annum (tpa), with a projected mine life of 30 years (Industrial Minerals 1989). Barrack Mine Management Incorporated, the Canadian arm of Barrack Mines Limited of Australia, is considering an option agreement for a 70 percent interest in the project.

Cal Graphite Corp. Butt Township Graphite Deposit

Now that work has started on developing the open pit, it is possible to view the deposit in three dimensions. As yet, the third dimension exposure is limited, but it is interesting to note that the two types of graphite-bearing rocks (Garland 1987) are distinguishable in fresh exposures. The nongraphitic rocks are in the form of blocks and the graphitic units appear to "wrap" themselves around these blocks. The structures viewed on the surface, can also be seen very prominently in the downdip direction.

Chapman Township Amazonite

The Bluestar Mine in Chapman Township continues to offer mineral collecting trips to tourists, who have the opportunity to collect the amazonite which occurs in a local pegmatite.

The McGown Mine, Foley Township

The McGown Mine is situated in Lot 146, Concession B, Foley Township, just east of Highway 69, near Parry Sound. The original copper-gold showing was discovered in 1894 by T. McGown, who formed the McGown Gold Mining Company. Between 1897 and 1898, this company sank an inclined shaft into one of the showings, and erected a 10 stamp gold mill on site, of which the foundations are still present. Between 1898 and 1902, the Parry Sound Copper Company acquired the property and sank three vertical shafts. Copper ore was shipped to the Orford Copper Company in Parry Sound. Average values for the ore ran 15 percent copper and between 0.08 and 0.18 ounce Au per ton (Satterly 1943; Assessment Files, Resident Geologist's Office, Ministry of Northern Development and Mines, Dorset).

The rock, which was previously termed hornblende-garnet gneiss, is a massive to banded, gabbroic-looking unit containing hornblende and feldspar and varying in texture from a gabbro to gabbroic gneiss. Although recrystallized, there are many places in outcrop where the original textures are apparent. There are also places in outcrop where the rock has been completely migmatized, containing large metamorphic orthopyroxene crystals. Mineralization consists of bornite, chalocite and gold, contained in quartz veins which seem to be parallel to the foliation, when present.

The Wilcox Copper Mine

The Wilcox copper mine is located on the north shore of Spider Bay on Georgian Bay, Concession 4, lots 18, 19, 20, 21 and 22, Cowper Township. Access, then as now, is by water from Parry Sound. The deposit was discovered in 1893, by H. Harris and T. Wilcox. The Parry Sound Copper Mining Company acquired the property and produced 40 t of copper concentrate between 1903 and 1904. The copper ore was smelted on site and shipped by barge to Depot Harbour. Two shafts, an open cut, and eight pits were excavated by the Parry Sound Copper Mining Company along the 700 m of mineralization. Between 1939 and 1961, the property was held by Waterways Copper Company and then by Kalbrook Mining Company. Average values for the ore were 3 percent Cu and 0.4 ounce Ag per ton.

The mineralization consists of discontinuous lenses of disseminated to locally almost massive pyrite, chalcopyrite, sphalerite and pyrrhotite contained in a massive quartz-rich unit up to 5 m wide, but usually 1 to 3 m wide. The rocks to the north of the mineralized zone consist of grey, fine- to medium-grained quartz-feldspar-garnet-biotite gneiss. South of the mineralized zone, the rocks consist of boudins and lenses of gabbroic-looking material folded within a hornblende-garnet gneiss. It appears that the zone of mineralization is situated between these two gneisses.

The Bayshore Copper-Zinc Prospect

The Bayshore prospect consists of 10 pits, located in Concession 4, Lot 17, Cowper Township, in the narrows between Spider Bay and Spider Lake. It was discovered in 1942, as a result of a geophysical survey on the Wilcox deposit to the southwest. Bayshore Zinc and Copper Mines Limited did the original trenching between 1942 and 1944. Kalbrook Mining Company acquired this property with the Wilcox deposit, and proceeded with a diamond-drilling program.

Mineralization consists of pyrite, pyrrhotite, sphalerite and minor chalcopyrite, disseminated in a matrix of blue quartz. The mineralized quartz unit lies along the contact between a quartz-feldspar-garnet-biotite gneiss on the north side, and a hornblende-garnet gneiss on the south side. Average assay values over 1 to 4 m in drill core are 6 percent Zn and 1 percent Cu.

Consolidated Copper Company, Spider Lake

Two shafts are located on the north shore of Spider Lake, Concession 96, Lot 9, Cowper Township. Operations were carried out by the Consolidated Copper

Company, Parry Sound, in 1902 to 1904. Mineralization consists of chalcopyrite, pyrite and pyrrhotite in blue quartz. The mineralized zone is in the contact between a mafic hornblende-garnet gneiss, and a quartz-feldspar-biotite gneiss.

Richmond Lake Occurrence

The Richmond Lake occurrence consists of a shaft, situated in Concession XI, Lot 27, Foley Township. The surrounding rock is a feldspar-hornblende gabbroic-looking unit, similar to the rocks found at the McGown Mine. Mineralization is reported to be bornite and chalcopyrite (Satterly 1943), although only a little chalcopyrite was seen.

Rinky Dink Mine

Located on the east end of McLaren Island, near the narrows in the South Channel (Georgian Bay), this mine consists of an adit 200 m into a hill, with one shaft of at least 25 m depth at the end, and one of unknown depth at the beginning. The adit is water filled, and access is by boat inside the adit. The rock consists of a hornblende-feldspar gneiss, and mineralization consists of massive to disseminated pyrite and chalcopyrite.

RESEARCH BY RESIDENT GEOLOGIST'S OFFICE STAFF

GEOLOGY AND ECONOMIC POTENTIAL OF THE BASE AND PRECIOUS METAL OCCURRENCES IN THE PARRY SOUND–HUNTSVILLE AREA, GRENVILLE PROVINCE

by M.I. Garland

Introduction

This report describes field work conducted during 1989, the second year of a project investigating the geology and economic potential of the base and precious metal occurrences in the Parry Sound and Huntsville area (Figure 17.1). During 1989, the field work concentrated on mapping in detail around existing mineral occurrences in order to better understand their geological setting, and on reconnaissance mapping in selected areas to gain an insight into lithological relationships on a regional scale.

Mineral Exploration

The base and precious metal occurrences in the area have a very interesting exploration history: they were almost all mined at the turn of the century, and several of them actually produced ore that was refined and marketed (Satterly 1943; Hewitt 1967). The Nickel Cliff Mine in Armour Township had a 10 m shaft that was sunk between 1900 and 1902 for copper and nickel (Satterly 1943). The McGown copper-gold occurrence in Foley Township was originally mined in 1894, and mining by the Parry Sound Copper Mining Company continued up to 1908. In the 1950s, the deposit was drilled by Kalbrook Mining Company Limited, and in 1964–1965, the shafts were dewatered and a bulk sample taken by R.M. Clarke Mining Company Limited (Satterly 1943; Hewitt 1967). The Consolidated Copper Company of Parry Sound sank a 50 m shaft on a sulphide occurrence on Spider (Cowper) Lake, in 1902–1903. The Wilcox Mine on Spider Bay was discovered and developed by H. Harris and T. Wilcox, and by the Parry Sound Copper Mining Company Limited from 1893 to 1904. The deposit was drilled by Waterways Copper Mines Limited in 1939, and again by Kalbrook Mining Company Limited in 1951 (Satterly 1943; Hewitt 1967). Bayshore Zinc and Copper Mines Limited drilled 30 holes on a sulphide zone east of the Wilcox Mine in 1942–1944, and Kalbrook Mining Company Limited drilled this prospect again in 1951.

Mapping in the area consists of work to the north by the Ontario Geological Survey (McRoberts and Tremblay 1988; Bright 1987), and by the Geological Survey of Canada (Culshaw et al. 1988). J. Trussler and D.J. Villard mapped the Parry Sound–Twelve Mile Bay area in 1975 (Algonquin Resident Geologist's Files, Ministry of Northern Development and Mines, Dorset).

Geology

The sulphides are associated with mafic rocks. The occurrences in the Muskoka Domain are in isolated norite bodies. The sulphides in the Parry Sound Domain occur in what has been termed mafic gneisses, or garnet amphibolite gneisses, outcropping in a band adjacent to the Parry Sound shear zone. Sulphide mineralization is either in quartz veins, or disseminated throughout the matrix of the rock, depending on the occurrence. What these rocks represent and what the control of the mineralization is will be two of the topics examined within the scope of this project.

Current Work

Most of the occurrences have been mapped in an effort to relate the mineralization to the surrounding geology. When possible, magnetometer and VLF-EM surveys are undertaken over the known mineralization. Detailed mapping has been done on the Nickel Cliff, McGown, and the Wilcox mines, and reconnaissance mapping was carried out in selected areas between Waubamik and Highway 518. This project will continue, and will eventually tie in to the mapping done by the Ontario Geological Survey and the Geological Survey of Canada.

INDUSTRIAL MINERALS AND BUILDING STONE

by C. Marmont

Field work was completed for the fourth year of a program to evaluate the industrial mineral and building stone potential of the Muskoka–Parry Sound–Nipissing area. This project is funded under the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), which is a subsidiary agreement to the Eco-

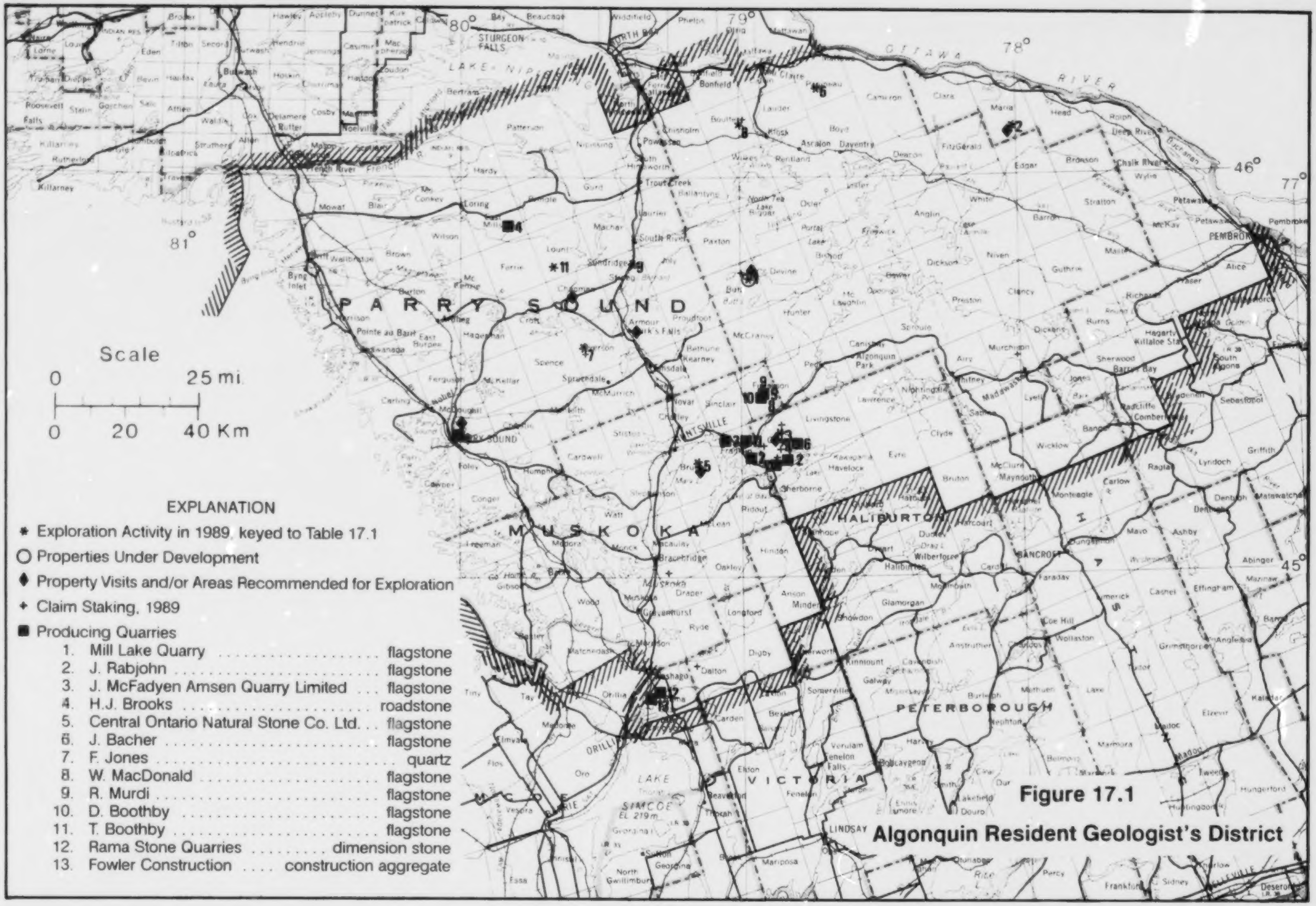

Scale
0 25 mi.
0 20 40 Km
EXPLANATION
* Exploration Activity in 1989, keyed to Table 17.1
○ Properties Under Development
◆ Property Visits and/or Areas Recommended for Exploration
+ Claim Staking, 1989
■ Producing Quarries
1. Mill Lake Quarry .... flagstone
2. J. Rabjohn .... flagstone
3. J. McFadyen Amsen Quarry Limited ... flagstone
4. H.J. Brooks .... roadstone
5. Central Ontario Natural Stone Co. Ltd. .. flagstone
6. J. Bacher .... flagstone
7. F. Jones .... quartz
8. W. MacDonald .... flagstone
9. R. Murdi .... flagstone
10. D. Boothby .... flagstone
11. T. Boothby .... flagstone
12. Rama Stone Quarries .... dimension stone
13. Fowler Construction .... construction aggregate
PARRY SOUND
MUSKOKA
HALIBURTON
PETERBOROUGH
VICTORIA
OTTAWA RIVER
LAKE NIPISSING
LAKE SIMCOE
STURGEON FALLS
PEMBROKE
BANCROFT
LINDSAY
80°
79°
78°
77°
81°
46°
45°

Figure 17.1

Algonquin Resident Geologist's District

nomic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

Field work on building stone focussed on banded (multicoloured) granites (orthogneiss) and on flagstone. The former are potentially suitable as architectural or dimensional stone for sawing into thin veneers for wall cladding and flooring (Ministry of Northern Development and Mines 1989). The latter find application as patio stone, fireplace surrounds, interior and exterior wall veneer and a host of other uses where a more rustic or natural appearance is preferred (Fouts and Marmont 1989; Ministry of Northern Development and Mines 1989).

Work on multicoloured granites included reconnaissance roadside surveys in the eastern half of the Algonquin Resident Geologist's District; follow-up surveys in areas which appeared to have a low density of joints, uniform colour, texture and grain size; and the extraction of blocks (0.5 by 0.5 by 0.5 m) for sawing and polishing tests. At this time, and on the basis of surface investigation only, it appears that there are only two or three sites capable of supplying a reasonable proportion of large quarry blocks (> 20 t). However, several sites may be capable of producing blocks in the order of 7 to 10 t.

R. McBride is investigating the possibility of redeveloping his granite quarry at Sundridge. The quarry previously operated during the 1920s, and supplied setts for the Yonge Street streetcar tracks in Toronto. The stone is a granular, pinkish-orange, lineated granite which can be readily split into rectangular blocks. Joint density is fairly low, permitting the removal of blocks well in excess of 10 t.

Work on flagstone mainly involved the examination of known past and currently producing quarries. There appears to be potential for further development in this industry as discussed below.

Enquiries have been received during the year on anorthosite and gabbro as possible feedstock for rock wool production; and on anorthosite as a source of feldspathic sand.

Some interest has been shown in the dimensional stone potential of the area.

Flagstone

Gneissic flagstones in the Algonquin District have a wide range of compositions and colours, and vary in their ability to be split. Most are granitic, but some are amphibolite, anorthosite or quartzite. They are much harder than the limestone and sandstone flagstones of southern Ontario. They are also harder to split, and are usually sold in random shapes and sizes; most sedimentary flagstones split very easily and are usually sold as "regular" (square) flagstones with sawn or rough edges.

Many gneissic flagstone quarries have operated intermittently in the Algonquin District for decades, but most produce only a few tens of tonnes of stone per year (Martin 1983). With the continuing construction boom in southern Ontario and a trend toward the use of natural materials, there appears to be a good opportunity to develop local flagstone resources for this market. At present there is virtually no promotion of these attractive stones. Stone dealers in southern Ontario require significant volumes of stone, delivered at short notice. Most local producers operate on a small scale and do not have the financial resources to expand when they do not have a guaranteed market. This is another example of the eternal "chicken and egg" problem. However, experience in the USA has shown that markets can be developed fairly easily, once the consumer is aware of a product's availability. Many of the flagstone quarries in the Algonquin District are candidates for expansion. In addition, they occur in fairly well-defined geological zones whose extent suggests that there are abundant additional resources of stone. Notable concentrations of flagstone quarries occur in the Minden, Huntsville–Dorset and Parry Sound areas.

RECOMMENDATIONS FOR EXPLORATION

With the completion of additional mapping in the western Parry Sound area, a geological pattern is starting to emerge, and it appears that the mafic gneisses and gabbroic rocks deserve some prospecting for base and precious metals. It is hoped that as the Staff Geologist's research continues, a better understanding of the mineralization in the area will be forthcoming.

As a direct result of research conducted in the district, we now have a much better understanding of the potential for architectural stone as well as flagstone. Although conventional exploration methods and philosophy make it difficult to evaluate an architectural stone occurrence, the authors still feel that there is good potential for extracting large blocks from within the gneisses.

RESEARCH BY OTHER AGENCIES

GEOLOGICAL SURVEY OF CANADA

N. Culshaw (Dalhousie University) completed the final year of a three-year geological mapping program, which covers the strip between Georgian Bay on the west, Highway 69 on the east, the French River on the north and Port Severn on the south, providing a good cross section of the Central Gneiss Belt at a scale of 1:50000.

UNIVERSITIES

R. Macfie continued his research on the structural relationships between the Parry Sound, Seguin and Rosseau domains.

SELECTED PUBLICATIONS RECEIVED

Culshaw, N.G., Corrigan, D., Drage, J. and Wallace, P. 1988. Georgian Bay geological synthesis: Key Harbour to Dillon, Grenville Province of Ontario; *in* Current Research, Part C, Geological Survey of Canada, Paper 88-1C, p.129-133.

Hornbrook, E.H. and Friske, P.W. 1989. National geochemical reconnaissance lake sediment and water data, central Ontario (31E(N1/2), parts of 31K, 31L); Geological Survey of Canada, Open File 1956.

REFERENCES

Bright, E.G. 1987. Precambrian geology of the Whitestone Lake area, District of Parry Sound; Ontario Geological Survey, Preliminary Map P.3095, scale 1:15 840.

Culshaw, N.G., Check, G., Corrigan, D., Drage, J., Gower, R., Haggart, M.J., Wallace P. and Wodicka, N. 1989. Georgian Bay geological synthesis: Dillon to Twelve Mile Bay, Grenville Province of Ontario; *in* Current Research, Part C, Geological Survey of Canada, Paper 89-1C, p.157-163.

Culshaw, N.G., Corrigan, D., Drage, J. and Wallace, P. 1988. Georgian Bay geological synthesis: Key Harbour to Dillon, Grenville Province of Ontario; *in* Current Research, Part C, Geological Survey of Canada, Paper 88-1C, p.129-133.

Fouts, C.R. and Marmont, C. 1989. Gneisses of the Parry Sound–Muskoka area: flagstone resources; Ontario Geological Survey, Open File Report 5725.

Garland, M.I. 1987. Graphite in the Central Gneiss Belt of the Grenville Province of Ontario; Ontario Geological Survey, Open File Report 5649.

Hewitt, D.G. 1967. Geology and mineral deposits of the Parry Sound–Huntsville area; Ontario Department of Mines, Geological Report 52, 65p.

Industrial Minerals 1989. Australian interest in Canadian graphite; November, p.9.

Keevil, R.R. 1976. Geology of the Ni-Cliff area Burk's Falls, Ontario; unpublished BSc thesis, University of Western Ontario, London.

Martin, W. 1983. Industrial minerals of the Algonquin region; Ontario Geological Survey, Open File Report 5425.

McRoberts, G.R. and Tremblay, M.L. 1988. Precambrian geology of the Ferrie River area, District of Parry Sound; Ontario Geological Survey, Preliminary Map P.3123, scale 1:15 840.

Ministry of Northern Development and Mines 1989. Building stone opportunities in central Ontario; by the staff of the Algonquin Resident Geologist's Office, Dorset, 16p. (Available on request from the Algonquin Resident Geologist's office.)

Satterly, J. 1943. Mineral occurrence on the Parry Sound District; Ontario Department of Mines, Annual Report, 1942, v.51, pt.2, 106p.

Villard, D.J., Keevil, R. and Hogg, A. 1984. The gold potential of the Huntsville–Parry Sound area of Ontario; Ontario Geological Survey, Open File Report 5521.

18. Southeastern Resident Geologist's District—1989

S. van Haaften[1], P.W. Kingston[2] and V.C. Papertzian[3]

[1]Staff Geologist, Southeastern Resident Geologist's Office, Southern Ontario Region.

[2]Resident Geologist, Southeastern Resident Geologist's Office, Southern Ontario Region.

[3]Drill Core Library Geologist, Tweed Drill Core Library, Southern Ontario Region.

INTRODUCTION

During 1989, 29 mines operated in the Southeastern District producing building stone, gemstones, industrial minerals and magnesium. Many pits and quarries produced construction aggregate.

Stewart Lake Resources Incorporated's graphite property in Bedford Township underwent advanced exploration; mineral exploration activity in the District remained at a fairly high level.

The Resident Geologist and his staff moved into newly built offices in February 1989. These offices were built onto the Tweed Drill Core Library on Old Troy Road, about 1 km north of Tweed. The new building was officially opened on November 16, 1989, by the Honourable Hugh P. O'Neil, Minister of Mines.

MINING ACTIVITY

A total of 29 mines operated in the District during 1989. Pluess-Stauffer A.G. purchased Steeprock Resources Incorporated. Production at the company's Perth area calcite mine and processing plant increased steadily over the past few years, and another plant expansion was underway in 1989. High demand for calcium carbonate may possibly result in the development of additional eastern Ontario marble deposits which are controlled by Pluess-Stauffer A.G.

Easton Minerals Limited shipped dolomite from its new property in Griffith Township to the Northbrook mill on a trial basis. The Northbrook mill continued to process dolomite from the Canada Talc Limited mine at Madoc.

Mining activity is shown in Figure 18.1 and listed in Table 18.1.

ADVANCED EXPLORATION AND DEVELOPMENT

Stewart Lake Resources Incorporated announced in a press release in October that it had received the feasibility study prepared by Kilborn Limited. The company has for several years been exploring the Kirkham flake graphite property on Desert Lake in Bedford Township. In 1988, the company put down an exploration decline and mined 3000 tons of flake graphite ore to facilitate metallurgical testing, mill design work, and market analysis as the basis for a final feasiblity study. A total of 200 tons of ore was trucked to the Ontario Research Foundation in Mississauga.

The October 1989 press release stated that the feasibility study "concludes that the Kirkham Flake Graphite Project can be successfully developed and placed into production at an estimated cost of $9.8 million producing a discounted cash flow rate of return to Stewart Lake of about 23%". The press release discussing the feasiblity study also stated:

> "Mining Plans call for the initial development of Zone 2 by quarry in the first 3 years with ensuing underground development of Zone 2 in years 3 through 9. Zone 1 South will be developed from underground during years 10 through 12.
>
> Mineable, diluted mining reserves total 1,020,000 tons grading 8.61% graphitic carbon, sufficient for approximately 12 years of operation. Other graphite zones including Zone 1 North, Zone 3, the southern extension of Zone 1 South and the additional known geophysical conductors have not been included in this study. However, the geology and drill results to date indicate that on-going expansion of mineable reserves is achievable and Stewart Lake anticipates a viable, long-term mining operation at its Kirkham Flake Graphite Mine...
>
> . . . The production schedule calls for construction to begin by mid 1990 with full scale production start-up slated for the end of 1990."

Mangrove Bay Resources Incorporated and A. Dubbelstein obtained an Official Plan amendment in 1989, allowing mining of their dolomite property in Mayo Township. This dolomite may be suitable for mineral filler, decorative stone chips and landscaping stone.

Exploration activity is shown in Figure 18.2, and listed in Table 18.2.

EXPLORATION ACTIVITY

Exploration activity indicators in Table 18.3 show relatively high activity in the Southern Ontario Mining Division. It seemed to the Resident Geologist's staff that exploration activity was actually down considerably from 1988, but the indicators in Table 18.3 show that much work was being submitted to keep claims in good standing. There were 2117 active mining claims in the Mining Division on November 30, 1989.

Exploration activity focussed on industrial minerals and gold. Although much exploration in the district takes place on patented land, it was possible to identify 32 active exploration sites in the district.

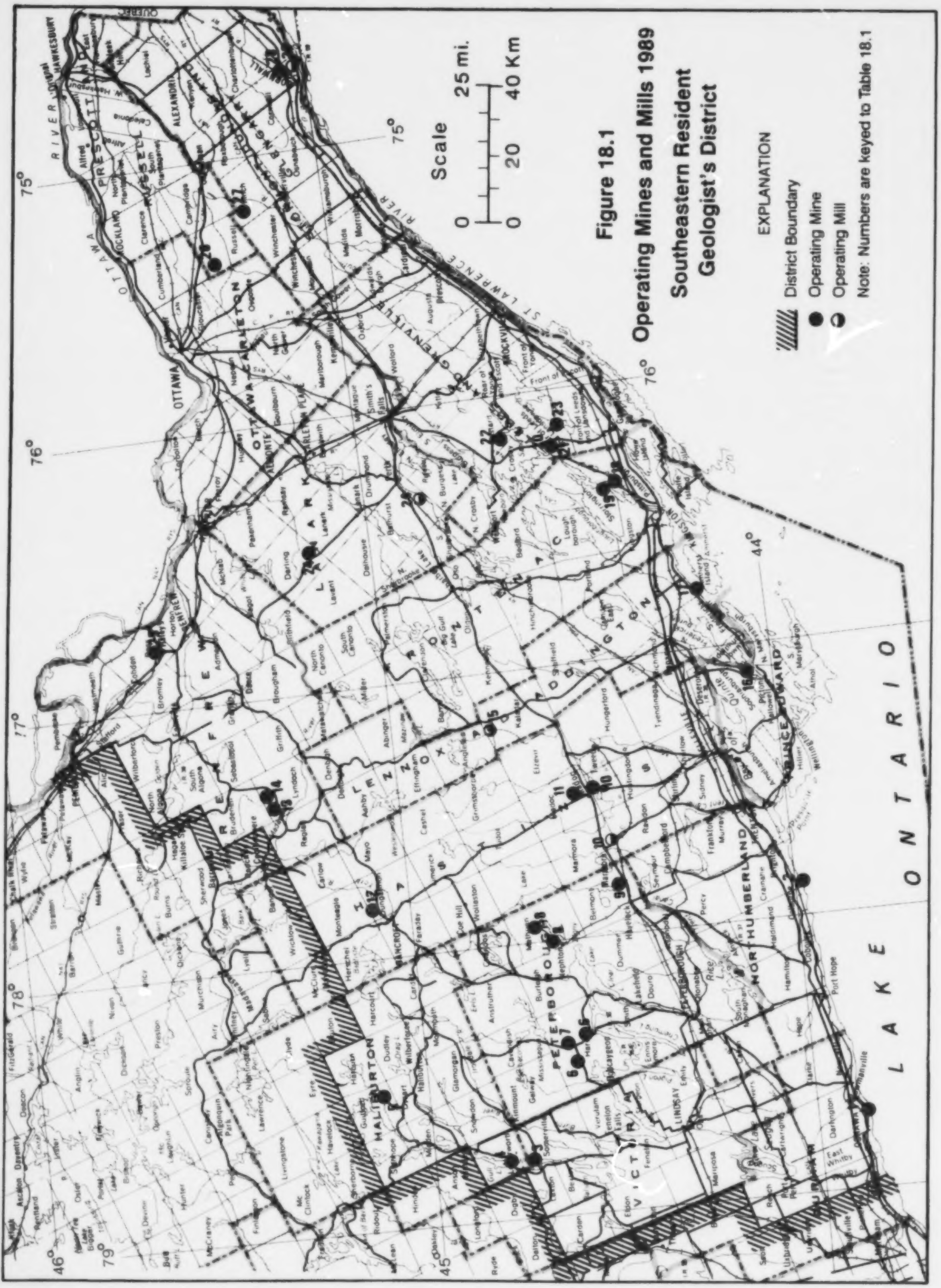

Scale
0 25 mi.
0 20 40 Km
EXPLANATION
District Boundary
Operating Mine
Operating Mill
Note: Numbers are keyed to Table 18.1
LAKE ONTARIO
OTTAWA RIVER
ST LAWRENCE RIVER
75°
76°
77°
78°
79°
44°
45°
46°

Figure 18.1
Operating Mines and Mills 1989
Southeastern Resident Geologist's District

TABLE 18.1. MINING ACTIVITY 1989.

Map No.	Company	Mine	Location (Township)	Commodities	Notes
1	St. Mary's Cement Ltd. (Bowmanville)		Darlington	Cement	Cement is produced on site.
2	Saint Lawrence Cement Co. Ltd.		Cramahe	Cement	Mine only. Rock is barged to Clarkson plant near Oakville for processing.
3	Central Ontario Natural		Somerville	Stone	Flagstone
4	MacDonald		Lutterworth	Stone	Flagstone
5	Bolenders Ltd.		Guilford	Dolomite	Dolomite (marble): poultry grit, golf sand, decorative aggregate, white powder sold for use in bricks and mortar.
6	Windover, N.		Harvey	Limestone	Flagstone
7	Ormell Sand and Gravel		Harvey	Limestone	Flagstone is produced from this limestone aggregate quarry
8	Indusmin Division of Falconbridge	Blue Mountain, Nephton, Cabin Ridge quarries	Methuen	Nepheline Syenite	Nepheline syenite is produced from two mines in this township. Magnetite is also produced.
9	3 M Canada Inc.		Belmont	Traprock	Roofing granules are produced from traprock at this mine.
10	Canada Talc Ltd.	Henderson & Conley Mines	Huntingdon	Talc, Dolomite	Talc products, and ground and crushed dolomite products including terrazzo chips are produced from this mine. This company operates mills at the mine site and at Marmora.
11	Stoklosar Marble Quarries Ltd.		Madoc	Marble	Marble chips (terrazzo)
12	Paul Rasnussen	Princess Sodalite Mine	Dungannon	Gemstones	Sodalite is mined, and sold for mineral specimens.
13	Wal-Gem Lapidary	Wal-Gem West Quarry	Lyndoch	Gemstones, Stone	Rose quartz mineral specimens were mined. Rock chips for decorative aggregate have been mined in the past, and in 1988 some small granite blocks were mined for use as 'field stone' construction material. Wal-Gem ceased operations in the fall of 1989.
14	Wal-Gem Lapidary	Wal-Gem East Quarry	Lyndoch	Gemstones	Mineral specimens, especially beryl. This site was opened to mineral collectors for a daily fee. Wal-Gem ceased operations in the fall of 1989.
15	Easton Minerals Ltd.	Northbrook Mill	Kaladar	Industrial Minerals	This mill (no mine) processes talc and dolomite from Madoc, granite from Rear of Leeds and Lansdowne Township, and silica.
16	Lake Ontario Cement Ltd.		Sophiasburg	Cement	Cement is produced on site.
17	Canada Cement LaFarge Ltd. (Bath)		Ernestown	Cement	Cement is produced on site.
18	Hughes, W.		Pittsburgh	Silica	Sandstone is mined for silica, and sold for use in manufacture of portland cement.
19	Sloan, N.	Sloan Quarry	Storrington	Sandstone	Sandstone building blocks (ashlar).
20	Easton Minerals Ltd.		Rear of Leeds and Lansdowne	Granite	Decorative red granite aggregate is produced from this quarry.
21	Granimar Quarries Ltd.	Straw Hill Quarry	Rear of Leeds and Lansdowne	Granite	Red granite blocks are mined, and shipped to dimension stone plants.
22	Arriscraft		Bastard	Sandstone	Sandstone for manufacture of reconstituted sandstone. Raw material is shipped to Cambridge, Ontario for processing.
23	Jackson, Rideauview Contractors		Rear of Leeds and Lansdowne	Sandstone	Sandstone building blocks (ashlar).
24	Steep Rock Resources Inc.	Tatlock Quarry	Darling	Calcite	High-purity, fine-grind calcite for fillers, plus other grades of calcite, and marble chips. Mill is west of Perth.

TABLE 18.1. CONTINUED.

Map No.	Company	Mine	Location (Township)	Commodities	Notes
25	Chromasco Ltd. (Div. of Timminco)		Ross	Magnesium	Magnesium is produced from dolomite mined at this location. Strontium, Calcium are produced from purchased material.
26	Canada Brick Division, Jannock Ltd.		Russell, Gloucester	Clay Products	Brick, from red shale. Quarry in Russell Tp, Plant in Gloucester Tp.
27	A.L. Blair Construction Ltd.		Finch	Lime	Agricultural Lime is produced from this crushed aggregate quarry.
28	Cornwall Sand and Gravel		Cornwall	Limestone	Limestone blocks for dimension stone are produced from thick upper beds of this crushed stone quarry.
29	Karnuk Marble Industries Inc.		Cornwall	Dimension Stone	This high-technology dimension stone finishing plant produces tiles and panels from marble and granite purchased off site.

GOLD EXPLORATION

Gold exploration has spread out in recent years and much grass roots activity has taken place in 1989. A few years ago, gold exploration mainly focussed on increasing reserves at, and exploring around, known precious metal concentrations in the Belmont Township, Marmora, Madoc and Northbrook areas.

During 1989, many mining claims were explored for gold across a large area from Peterborough County to Lanark County. Homestake Mineral Development Company is an important participant in this activity. There were no large diamond-drill programs reported for gold in 1989, but the exploration industry undertook many geological mapping, geochemistry and geophysics programs. Promising areas were stripped and examined in detail.

The Northern Miner of November 6, 1989, reported on Noranda Incorporated's Dingman gold project in Marmora Township. This property was included in a list of eight properties which, in the company president's estimation and in *The Northern Miner's* words, had "a fifty-fifty chance of joining the Noranda group's stable of gold and base metal mines". *The Northern Miner* article also reported that the project "is a high tonnage, low grade gold project (exact reserves are undisclosed) located near Marmora" and that "it is currently on hold pending results of metallurgical tests".

INDUSTRIAL MINERALS EXPLORATION

In industrial minerals exploration, Strathcona Mineral Services Limited carried out a diamond-drill program late in 1989 for the Kaladar Township flake muscovite mica property. The mica from this property could potentially be used as a structural filler in plastics.

Easton Minerals Limited's Griffith Township dolomite property was mined on a trial basis early in 1989. This property was diamond drilled in 1988; the dolomite has potential application as a filler and as decorative stone.

W.S. Kennedy drilled three diamond-drill holes totalling 1112 feet, to test a possible extension of the pegmatite body at the Richardson Feldspar Mine in Bedford Township. A body of quartz remains in the quarry at this former producer; the property is being explored as a possible source of high-purity silica and potassic feldspar.

R.G. Hawley continued to explore the "Timmins Mine", a graphite property in North Burgess Township. About 3000 feet of diamond drilling was done on this property in early 1989. In the September 12, 1988 issue, *The Northern Miner* reported that work on this property by Black Hawk Mining Incorporated and Lodi Metals Incorporated had "outlined a drill-indicated and inferred reserve of one million tons grading 8% graphite".

Harrington Sound Resources Incorporated explored graphite properties in Herschel and Lyndoch townships. The Lyndoch Township property was described in the literature as the Little-Bryan property (Storey and Vos 1981). Geological mapping, prospecting, trenching and channel sampling were carried out on these properties in 1989. Assessment work which was submitted by the company stated that grab samples taken from the Lyndoch property "have an average combined grade of 10.94% graphitic carbon" (Envoy et al. 1989).

Harrington Sound Resources Incorporated also explored for fluorite and barite on mining claims in Madoc and Huntingdon townships. In 1989, geological mapping, geochemical soil sampling and follow-up trenching were performed (Dickson and Trinder 1989).

Queensborough Road Properties Limited outlined a body of actinolite-bearing rock in Elzevir Township, and a bulk sample was taken and tested. During 1989, the company applied for an Official Plan amendment and a zoning bylaw amendment, in preparing to obtain a licence under the Pits and Quarries Control Act for this property.

In December 1989, Two Island Marble Corporation quarried test blocks of white, architectural marble from their property in Griffith Township.

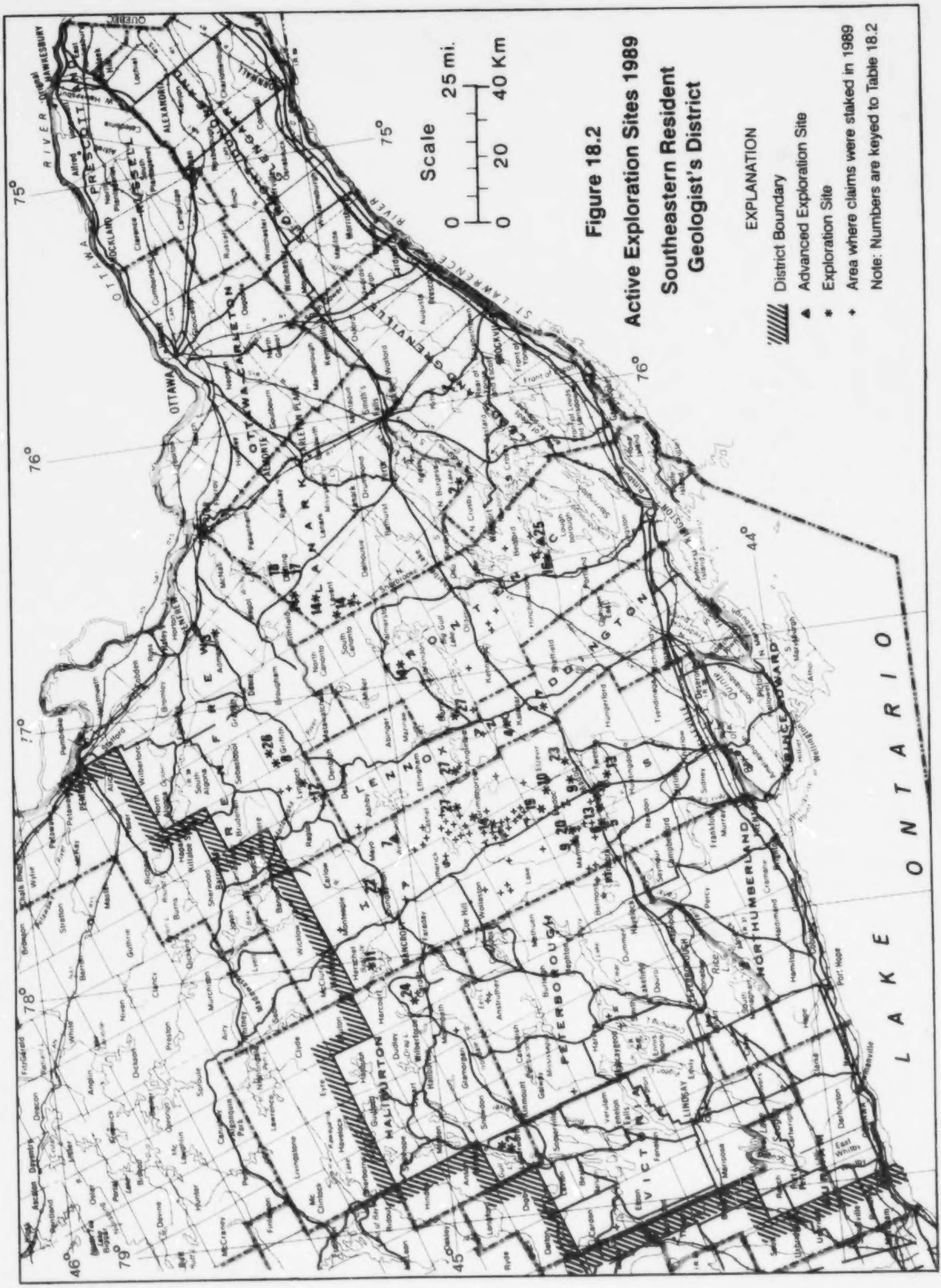

Scale
0 25 mi.
0 20 40 Km
75°
76°
77°
78°
79°
44°
45°
46°
LAKE ONTARIO
OTTAWA RIVER
ST. LAWRENCE RIVER
QUEBEC
OTTAWA
KINGSTON
PRESCOTT
RUSSELL
OTTAWA-CARLETON
LANARK
RENFREW
FRONTENAC
LENNOX AND ADDINGTON
HASTINGS
PETERBOROUGH
NORTHUMBERLAND
PRINCE EDWARD
HALIBURTON
VICTORIA
LINDSAY
BANCROFT
HAWKESBURY
BROCKVILLE

Figure 18.2

Active Exploration Sites 1989

Southeastern Resident Geologist's District

EXPLANATION

▨ District Boundary

▲ Advanced Exploration Site

* Exploration Site

+ Area where claims were staked in 1989

Note: Numbers are keyed to Table 18.2

TABLE 18.2. EXPLORATION ACTIVITY 1989.

Map No.	Company	Property Name	Location (Township)	Commodities Sought	Notes
1	Strathcona Mineral Services Limited	Kaladar Mica	Kaladar	Muscovite mica	This flake mica prospect was diamond-drilled in 1989.
2	Black Hawk Mining Inc and Lodi Metals Inc.	Timmins Mine	North Burgess	Graphite	This former producer was stripped and trenched in autumn, 1988. Recent work on the property includes diamond drilling, sampling/testing, and geological mapping. Drill-indicated and inferred reserves of 1 million tons @ 8% graphite.
3	Breakwater Resources Ltd, CAMECO	Cadieux, Renprior prospects	Admaston	Zinc, lead	Stripping, much diamond drilling have been carried out in recent years. Drill-indicated reserves of 987000 tons @ 10.4% Zn and 1.1% Pb.
4	Cathedral Gold Corp.	Addington or Golden Fleece Mine	Kaladar	Gold, silver	Diamond drilling 1987–1988 by Michele Gold Mines Limited outlined reserves in the 'D' zone. Over 24000 feet diamond drilling carried out by E&B Explorations Inc in 1981–84. Total geological reserve indicated by past work: 785000 tons @ 0.13 oz Au/ton
5	Champion Gold Resources Inc.	Ackerman Prospect	Marmora	Gold, silver	Diamond drilling has been carried out at this property over several years, including 1989.
6	Cominco Ltd. and Platinova Resources Ltd.	Deloro Wollastonite	Marmora	Wollastonite calcite	10feet diamond drilling, stripping, test pit and bench testing. Open-pit reserves: 450000 tons @ 47% wollastonite, another zone of 680000 tons inferred ore @ 39% wollastonite. Production decision had not been announced by December 1, 1989.
7	Dubbelstein, A., Mangrove Bay Resources Inc.		Mayo	Dolomite	This property has been under exploration for several years. Diamond drilling was carried out in 1988. A County Official Plan amendment to allow mining was obtained in 1989.
8	Easton Minerals Ltd.		Griffith Township	Dolomite	Diamond drilling and stripping were carried out in 1988, to outline this dolomite deposit. Some dolomite was taken from the property early in 1989, and milled at Northbrook.
9	Faith Mines Ltd.	Old Diamond Mine, Blakely Mine, Canada Sulphur Ore, Gawley	Madoc, Marmora	Gold, silver, copper, zinc	Geochemical surveys and diamond drilling were carried out by this company on several properties from 1985 to 1988. No new work was reported in 1989.
10	Gateford Resources Inc.	Cooper Gold	Madoc	Gold	Stripping and diamond drilling in late 1987. Diamond drilling in 1988.
11	Harrington Sound Resources Inc.		Herschel	Graphite	Geological mapping, trenching and channel sampling were done in 1989.
12	Harrington Sound Resources Inc.	Little–Bryan	Lyndoch	Graphite	Geological mapping, trenching and channel sampling were done in 1989.
13	Harrington Sound Resources Inc.		Madoc, Huntingdon	Fluorite	Geological mapping, geochemical soil sampling and follow-up trenching were done in 1989.
14	Homestake Mineral Development Co.		Clarendon, Darling, Grimsthorpe, Lavant, Tudor	Gold, silver	This company is exploring a number of properties in Eastern Ontario.
15	I.K.O. Industries Ltd.		Madoc	roofing granules ('andesite')	A bulk sample was removed in 1987, and a licence to operate was acquired in 1988 under the Pits and Quarries Control Act. Diamond drilling was carried out in 1988. No production decision been announced by December 1, 1989.
16	Kennedy, W.S.	Richardson Feldspar Mine	Bedford	Quartz, feldspar	This former feldspar producer was diamond-drilled in 1989.

TABLE 18.2. CONTINUED.

Map No.	Company	Property Name	Location (Township)	Commodities Sought	Notes
17	Kennedy, W.S.	Indian River	Darling	Graphite	Stripping and geological work have been carried out on this property.
18	Kinbauri Gold Corp.		Darling	Gold	Magnetometer and VLF surveys were done in 1988.
19	Micham Exploration Inc, Mono Gold Mines Inc.	Bannockburn Mine, and new deposit to the northeast	Madoc	Gold, silver	Underground exploration was carried out in 1988 to the 75-foot level, with underground drilling and drifting on the 75-foot level. 'Modified geological' reserves over minimum mining width of 6 feet: 248000 tons @ 0.27 oz/ton Au (uncut)
20	Noranda Inc.	Malone Gold Prospect	Marmora	Gold	Trenching, channel sampling 1986. Diamond drilling, more channeling 1987. More diamond drilling was done in 1988.
21	Northgate Exploration Ltd.		Lutterworth	Zinc	Geophysical and geochemical surveys have been carried out.
22	Pipawa Explorations Ltd & Jayfran Enterprises		Dungannon	Nepheline Syenite	The possibility of producing alumina and silica chemicals from rock on this property is being studied.
23	Queensborough Road Properties Limited	Queensboro Road Property	Elzevir	Actinolite	Diamond drilling was carried out in 1988. A bulk sample was taken out, and during 1989 efforts were underway to obtain a licence under the Pits and Quarries Control Act.
24	Rinaldi, R.V.		Cardiff		Diamond drilling was done in 1988.
25	Stewart Lake Resources Inc.	Kirkham, Bawden Graphite Properties	Bedford	Graphite	Kirkham property acquired by option, much other ground staked. Mineable, diluted mining reserves total 1020000 tons grading 8.61% graphitic carbon. This property could be developed and placed in production at a cost of $9.8 million.
26	Two Island Marble Corporation		Griffith	Dolomite dimension stone	Test blocks were extracted in 1988 and 1989. Two large areas had been stripped. The property was previously explored by Trisar Resources Ltd, as a source of dolomite filler.
27	United Reef Petroleums Ltd.		Anglesea, Barrie, Grimsthorpe	Gold	This company is exploring several properties.

TABLE 18.3. SUMMARY OF CLAIMS RECORDED AND ASSESSMENT WORK CREDITED, SOUTHERN ONTARIO MINING DIVISION.

Year	Claims Recorded	Claims Cancelled	Claims Active	Diamond Drilling (Man Days)	Geophysical Surveys (Man Days)	Geological Surveys (Man Days)	Other Work (Man Days)	Total Man Days
1980	548	721	1 699	17 648	6 665	2 822	3 584	30 719
1981	485	758	1 531	11 855	4 041	4 022	4 699	24 617
1982	354	617	1 115	9 546	8 372	481	8 927	27 326
1983	391	377	1 157	8 317	2 840	3 135	5 032	19 324
1984	555	498	1 254	9 928	23 500	322	3 786	37 536
1985	457	360	1 312	15 619	3 192	650	5 937	25 398
1986	744	426	1 579	15 829	3 623	3 843	9 304	32 599
1987	619	526	1 641	6 672	24 592	5 721	5 352	42 337
1988	982	404	2 255	17 643	24 345	2 284	10 087	54 359
1989 to November 30, 1989	569	721	2 117	21 163	12 860	3 657	6 611	44 291

RESIDENT GEOLOGIST'S STAFF ACTIVITIES

SERVICES

The Resident Geologist and his staff provided a consultative technical service to people engaged in mineral exploration and mining development in southeastern Ontario. This service involved consultations in the office and in the field, and use of the Resident Geologist's library, files and computer systems. The Resident Geologist's clientele also used the Tweed and Bancroft Core Libraries.

A variety of services are offered by the Southeastern District Resident Geologist and his staff:

1. technical consultations in the field, in the office, and by telephone
2. use of the Assessment Files, Mineral Deposit Files, library of maps, government reports, other printed material, and the associated computer data bases located at Tweed
3. use of Drill Core Libraries at Tweed and Bancroft, for examining archived drill core, and for logging newly drilled core
4. geological maps and reports, claim maps, and prospector's licences are sold by the Resident Geologist's Secretary

STAFFING

As of December 1989, the staff included: P. Kingston, Resident Geologist; S. van Haaften, Staff Geologist; C. Papertzian, Core Library Geologist; T. Neal, Secretary; D. Williams and P. LeBaron, COMDA Project Geologists. COMDA projects are part of the five-year Canada–Ontario 1985 Mineral Development Agreement, a subsidiary agreement to the Economic and Regional Development Agreement (ERDA), signed by the governments of Canada and Ontario.

B. Grant, Drill Core Library Geologist at Bancroft, resigned in August so that he could accept a position with the Ministry of Natural Resources in Napanee. The Bancroft Drill Core Library is currently operated on demand by C. Papertzian.

L. Thompson, Regional Geophysicist, retired in September. A. MacKinnon, COMDA Project Geologist and D. Burley, COMDA Clerk, worked until September 29 at which point their projects expired.

The Regional Specialist, H. Meyn, has an office at Bancroft and was assisted in 1989 by K. Fell, Secretary, and two summer students. The program of the Regional Specialist is separate from that of the Resident Geologist and in 1989, the Regional Specialist carried out research on mineral deposits in the Queensborough area. Claim tags, prospector's licences and publications are sold at the Bancroft office and the library is available for public use.

ACTIVITIES

In addition to providing regular services, the Resident Geologist and his staff undertook other activities.

Together with W.F. Caley of the Technical University of Nova Scotia, P. Kingston gave talks at the Canadian Institute of Mining and Metallurgy annual general meeting in Quebec City, and the Unified International Technical Conference on Refractories in California (Kingston, MacKinnon and Caley 1989; Caley, Didyk and Kingston 1989). P. Kingston was Session Chairman for the session on remote sensing at the Ontario Mines and Minerals Symposium held in Toronto, in December.

The Resident Geologist served on the Information Technology subcomittee and on the Geoscience Exploration Database (GED) working group. The subcommittee deals with the computer and information management systems of the Ministry of Northern Development and Mines (MNDM). The working group seeks to implement mineral deposit and assessment work databases in all the field offices and in the Geoscience Data Centre. The Staff Geologist also worked on GED.

The Resident Geologist also served on an internal MNDM Working Group to develop a Mineral Resources Policy Statement for use under the Planning Act. The Resident Geologist and the Drill Core Library Geologist were members of the Provincial Drill Core Library Co-ordinating Committee chaired by J.A. McIntosh, Regional Director, Northeastern Region.

The Resident Geologist and Staff Geologist visited selected mineral properties. In April, the Minister's Task Force on Industrial Minerals, the Regional Manager, the Resident Geologist and the Staff Geologist visited operating mines and industrial mineral prospects in the Southeastern District. The group also attended a meeting with the County of Peterborough Industrial Minerals Advisory Committee.

The staff at Tweed made a special effort to review all planning documents for Hastings County on a trial basis. S. van Haaften and P. Kingston reviewed all Official Plan (OP) amendment applications for six months, and all severance applications for one month. At the Southern Ontario Regional meeting in September, senior staff decided to stop routinely reviewing OP amendment and severance applications until the Ministry of Northern Development and Mines develops an official policy for municipal planning.

Tweed staff continued to review new and revised Official Plans. The Staff Geologist reviewed about six OPs in 1989, and also provided input to economic development studies for Frontenac County, Hastings County and the Golden Lake Native Band in Renfrew County.

As well, the staff worked on abandoned mine hazard issues. S. van Haaften visited three abandoned mines with staff from the Ministry of Natural Resources and the Ministry of Labour. P. Kingston participated in site visits and meetings concerning the de-commissioning of the Madawaska Mine at Bancroft.

Two Section 38 program participants completed the Tweedmin mineral occurrence database in 1989. This computer database and its associated paper files provide a convenient way for clients and staff to retrieve mineral occurrence information for the Southeastern District. The Resident Geologist's report for 1988 describes the computer data bases which are used in Tweed (Kingston et al. 1989).

H. Meyn, the Regional Specialist, and his staff set up a booth at the Bancroft Gemboree to sell geologically oriented publications issued by the Ministry of Northern Development and Mines. The ministry sponsored D.H. Gorman, formerly Professor of Mineralogy, University of Toronto, at this event to identify rocks and minerals for the rockhounds.

RESEARCH BY RESIDENT OFFICE STAFF

BUILDING STONE (COMDA)

D. Williams prepared a revised structural geology map (scale 1:250000) of the eastern part of the Lake Ontario Lowland, and submitted a preliminary version of this map for incorporation in *The Geology of Ontario*. The map will accompany a report (in preparation as of December 1989) which will include an evaluation of the economic potential of the Paleozoic rocks.

D. Williams logged drill core in order to acquire additional stratigraphic information from the following localities: Coldwater (Medonte Township), Brechin (Carden and Mara townships), Burnt River (Somerville Township) and Buckhorn (Harvey Township).

Ontario Geological Survey Open File Report 5706, *Building Stone Potential in Eastern Ontario* by P. LeBaron, C.P. Verschuren, V.C. Papertzian and P.W. Kingston was published in April 1989. This report was prepared in Tweed and funded under COMDA.

REFRACTORY MINERALS (COMDA)

Work in 1989 focussed on dolomite, as it has potential applications as a mineral filler, as a refractory mineral and as a magnesium metal source. P. LeBaron completed the mapping and sampling of 25 high-purity dolomitic marble prospects. A report by P. LeBaron and A. MacKinnon titled *Precambrian Dolomite Resources in Southeastern Ontario* was submitted to the Ontario Geological Survey (OGS) for publication as an Open File Report.

INDUSTRIAL MINERALS (COMDA)

OGS Open File Report 5714, *Talc in Southeastern Ontario* by P. LeBaron and S. van Haaften was published in September 1989. This report describes all known talc occurrences in southeastern Ontario. The report also gives results of beneficiation tests performed in 1988 and provides recommendations for exploration.

A paper entitled "New Industrial Mineral Opportunities in Eastern Ontario" by P.W. Kingston, A. MacKinnon and W.F. Caley was presented at the 91st Annual General Meeting of the Canadian Institute of Mining and Metallurgy (CIM) in May at Quebec City. This paper was approved for publication in the CIM Bulletin.

OGS Open File Report 5711, *Vermiculite in the Stanleyville Area, Lanark County, Eastern Ontario*, by A. MacKinnon, P.W. Kingston and J.S. Springer, was published in May 1989.

A. MacKinnon completed drafts of the Open File Reports *Wollastonite in Eastern Ontario* and *Major Graphite Occurrences within the Frontenac Axis, Southeastern Ontario*. The wollastonite report will be submitted for publication after Tweed MNDM staff incorporate information about a new wollastonite deposit which was recently discovered by industry.

GEOLOGY AND GEOPHYSICS OF FLUORITE DEPOSITS

L. Thompson, D. Williams, and assistants continued this project, which was partially funded by COMDA. In previous years, geological mapping and geophysical surveying in the Madoc area concentrated on locating faults and determining how they offset the stratigraphic units. In 1989, field work was carried out at sites near Thomasburg and Tweed, in Hungerford Township. Seismic, magnetic, resistivity (conductivity), alpha radiation, elevation and geological surveys comprised the work done.

Survey results were published in Thompson and Williams (1989). This report discussed how geophysical techniques can apply to the exploration for fluorite, and suggested a number of fluorite exploration targets in the Madoc area.

DIAMOND-DRILL CORE STORAGE PROGRAM

by V.C. Papertzian

TWEED DRILL CORE LIBRARY

The Tweed Drill Core Library was managed by V.C. Papertzian in 1989. K. Williams and T. Gray acted as assistants, from June through September, as part of the Experience '89 program.

The following resources and services are offered at the Core Library:

1. drill core from Southern Ontario
2. facilities for logging and splitting core
3. binocular and petrographic microscopes
4. rock cutting and polishing equipment
5. level and section plans from past producing mines in the area

As of November 24, 1989, 82751 m of core were in the Core Library catalogue, and approximately 10000 m of recently acquired core had yet to be catalogued. Table 18.4 summarizes the Tweed Drill Core Library's holdings. During 1989, 15375 m of core were catalogued.

Major contributors of core this year were: Mono Gold Mines Incorporated, who contributed core from

TABLE 18.4. SUMMARY OF TWEED CORE LIBRARY HOLDINGS, DECEMBER 1, 1989.

Township	Company	Depth Drilled (m)	Core Stored (m)	Commodity
ALICE	SITE INVESTIGATION LTD.	20.8	18.6	Engineering
ANGLESEA	ULTIMATE ENERGY RES.	398.6	256.7	Au
ATHOL	OGS HOLE	63.5	62.9	Engineering
BARRIE	GRANDAD RESOURCES	913.8	894.8	Au
BARRIE	HENRY COOK PROPERTY	76.2	76.2	Pb,Zn,Ag,Au
BARRIE	ORE CHIMNEY MINE	1 369.5	1 337.2	Au
BEDFORD	STEWART LAKE RESOURCES	101.5	100.6	Graphite
BELMONT	BLAIRTON IRON MINE	1 460.4	1 202.4	Fe
BELMONT	CORDOVA	2 875.3	2 489.6	Au
BELMONT	PERSHING IRON MINE	6 712.3	5 718.4	Fe
BELMONT	PREUSSAG	1 211.9	1 133.7	CaCO
CAMDEN EAST	ROBLINDALE QUARRY	17.0	16.8	Scientific
CHARLOTTENVILLE	OLIVER IRON MINING	5 290.4	1 891.5	Fe
CLARENDON	SELCO INC.	245.4	232.0	Zn
CLARENDON	ST. JOE'S EXPL. LTD.	905.0	905.0	Zn
DARLING	HOMESTAKE MINERAL DEVELOPMENT CO.	1 236.0	25.5	Au
DARLINGTON	ONTARIO HYDRO	18.8	7.3	Engineering
DURHAM	ONTARIO HYDRO	128.9	91.7	Engineering
EDWARDSBURGH	ONTARIO HYDRO	52.0	27.1	Engineering
ELMSLEY N.	GLOBE GRAPHITE MINE	698.2	634.0	Graphite
ELZEVIR	CORONA CORP	702.6	652.0	Au
ELZEVIR	STEEPROCK	516.2	492.0	Talc
ERNESTOWN	BETHLEHEM STEEL CORP	185.9	185.9	Fe
GRATTAN	SITE INVESTIGATION LTD.	111.2	108.1	Engineering
HARVEY	GORMLEY AGGREGATES LTD.	28.3	13.4	Engineering
HOPE	ONTARIO HYDRO	4 453.6	1 822.6	Engineering
HUNGERFORD	RAM PETROLEUMS LTD.	157.9	157.9	Mica
KALADAR	C.R. YOUNG	78.3	75.9	Mica
KALADAR	E&B EXPLORATIONS INC.	7 817.7	7 817.7	Au
KALADAR	J. BYERS	123.1	121.2	Feldspar
KALADAR	LACANA MINING CORP.	85.3	71.9	Mica
LANARK	SELCO CLYDE RIVER	1 448.3	1 267.4	Zn
LAVANT	HOMESTAKE MINERAL DEVELOPMENT CO.	264.8	4.8	Au
MADOC	BANNOCKBURN MINE	260.6	177.8	Au
MADOC	DERRY, MICHENER, BOOTH	600.9	591.1	Talc
MADOC	FREEPORT EXPLORATION	3 192.6	2 244.3	Base Metals
MADOC	HARWIN EXPL. & DEVEL.	792.5	792.5	Au
MADOC	MONO GOLD MINES INC.	17 964.2	17 852.6	Au
MADOC	SAGER	1 562.3	1 330.1	Base Metals
MADOC	SSFC/OGS	107.3	107.3	Scientific
MADOC	SYNGENORE	3 438.4	2 388.8	Base Metals
MADOC	TWIN BUTTES	150.3	150.3	Talc
MARMORA	ACKERMAN	37.1	37.0	Au
MARMORA	BELMAR RESOURCES INC.	374.1	361.0	Au
MARMORA	BETHLEHEM STEEL CORP	8 706.5	478.8	Fe
MARMORA	CHAMPION GOLD RESOURCES INC.	484.0	465.8	Au
MARMORA	GOLD BROOKE EXPL.	795.0	810.9	Au
MARMORA	MARMORATON IRON MINE	4 080.5	3 602.5	Fe
METHUEN	PREUSSAG	190.6	175.7	CaCO
MEDONTE	MINISTRY OF TRANSPORTATION	30.8	29.9	Engineering
NORTH BURGESS	LODI METALS INC.	250.9	242.0	Graphite
NORTH BURGESS	O.M.N.R.	52.4	51.6	Vermiculite
NORTH CROSBY	MTC WESTPORT DDH	32.0	32.0	Engineering
OLDEN	LYNX CANADA EXPL.	15 825.8	14 711.5	Zn
OPS	OGS/SSFC	155.1	149.3	Scientific
ORILLIA	SPARROW LAKE	18.0	16.9	Limestone
OTONABEE	MURRAY LITTLE PROPERTY	96.3	90.8	Engineering
PALMERSTON	FAIRFIELD PROJECTS	152.4	146.8	U
PICKERING	ONTARIO HYDRO	326.4	216.7	Engineering
PRESCOTT	ONTARIO HYDRO	6.7	2.1	Engineering
RAMA	LONGFORD DRILLHOLE	33.8	7.0	Engineering
RAMSAY	J.M. BELL	665.4	665.4	Base Metals
SEYMOUR	ALLAN'S MILLS	3 530.8	3 170.1	Fe
SOMMERVILLE	DUDMAN QUARRY CO.	56.5	19.6	Engineering
SOMMERVILLE	MASON PROPERTY	31.7	5.2	Limestone
SOMMERVILLE	OGS/SSFC	28.0	28.0	Scientific
SOUTH FREDRICKSBURG	LENNOX GENERAT. STN.	107.5	107.5	Engineering
THURLOW	SITE INVESTIGATION LTD.	53.1	38.0	Engineering
TUDOR	WOLFEX EXPL. LTD.	75.8	75.8	Au,Ag
TYENDINAGA	ONTARIO HYDRO	207.4	159.7	Engineering
WENTWORTH PQ	BLACK GREGOR EXPL.	84.4	83.1	Graphite
WOODHOUSE	OLIVER IRON MINING	1 540.5	509.1	Fe
TOTAL		105 867.3	82 751.0	

their Bannockburn property in Madoc Township; Corona Corporation, who contributed core from eight holes from their property located in Elzevir Township; and Lasir Gold Industries Incorporated. Lasir Gold Industries Incorporated donated 8000 m of core which was drilled in 1988 at the Cordova Mine in Belmont Township.

There were 59 visitors to the facility between January 1, 1989 and December 1, 1989.

BANCROFT DRILL CORE LIBRARY

The Bancroft Drill Core Library was staffed on a full time basis by W.T. Grant until September 1989. This position is now being filled by V.C. Papertzian on an as-needed basis from the Tweed Resident Geologist's office. Consequently, core can be viewed at the Bancroft facility by contacting the Tweed Core Library Geologist.

Drill core from the north part of the district and also from the Algonquin District is stored at the Bancroft facility. Table 18.5 summarizes core which is stored in the Bancroft Drill Core Library. Canadian Gold Resources Incorporated and Jayfran Enterprises contributed core this year.

RECOMMENDATIONS FOR EXPLORATION

BASE METALS

Marble-hosted, stratabound zinc-lead deposits are an important exploration target in the Central Metasedimentary Belt of the Grenville Province, yet little zinc exploration activity was reported in the Southeastern District. Zinc exploration in southeastern Ontario's marble belts is recommended.

The marble-hosted Long Lake zinc mine in Olden Township was most recently mined by Lynx Canada Explorations Limited and Canadian Reynolds Metals Company Limited in 1973 and 1974. A total of 9467 tons of zinc valued at $1227000 was extracted from March 1973 to February 1974, and the maximum depth reached was 115 feet (Wolff 1982). There may be potential for finding more zinc deeper in the ground at this site.

Breakwater Resources Limited and CAMECO—Canadian Mining and Energy Corporation, control the Cadieux zinc-lead prospect in Admaston Township, Renfrew County. This property is reported to have drill-indicated reserves of 987000 tons averaging 10.4 percent zinc and 1.1 percent lead (Northern Miner Press Limited 1989).

TABLE 18.5. SUMMARY OF BANCROFT CORE LIBRARY HOLDINGS.

Township	Company	Depth Drilled (m)	Core Stored (m)	Commodity Sought
Anstruther	Biron Bay Resources Ltd.	2 600.8	2 600.8	Fe, Ti
	Esso Minerals Canada	1 008.0	972.2	U, Th
	Glen Explorations	181.4	2.7	U, Th
	Northgate Exploration Ltd.	384.3	339.0	U, Mo
Blithfield	Ontario Hydro	174.2	127.5	Structure
Brougham	Coronation Resources	529.1	307.7	Graphite
	Ontario Hydro	204.9	98.8	Structure
Burleigh	L.V. Lomas Chem Co. Ltd.	243.8	3.6	Marble
Butt	Vesuvius Crucibles	1 248.3	1 163.0	Graphite
Cardiff	Esso Minerals Canada	3 558.1	3 019.1	U, Th
	Griffis, A.T.	294.4	3.8	Graphite
	Kenmac Chibougamau Mines	691.3	396.2	U, Th
	Kerr Addison Mines Ltd.	10 478.6	9 691.3	U, Th
Cashel	David McMurray	290.1	285.6	Talc
Cavendish	Quebec Uranium Mines Ltd.	459.3	6.0	U
Dungannon	Jayfran Enterprises	681.2	639.6	Neph Syen
Faraday	Madawaska Mines	3 234.3	632.6	U, Th
	Mercier Exploration	735.3	10.7	U, Th
Finlayson	Canadian Gold Resources Inc.	274.6	267.0	Au
Galway	Halas, Frank	504.4	6.0	U
Glamorgan	Esso Minerals Canada	943.1	732.0	U, Th
	Sulpetro Minerals Ltd.	373.7	373.7	Zn
Laurier	Trout Creek	161.8	131.0	Graphite
Limerick	Lac Minerals Ltd.	13 281.6	9 295.9	Cu,Ni,Co
Mayo	Falconbridge Ltd.	421.9	421.9	Fe
Methuen	Indusmin Ltd.	92.2	92.0	Neph Syen
Monmouth	Esso Minerals Canada	5 256.1	4 321.5	U
Monteagle	Esso Minerals Canada	192.8	177.7	U
	Forefront Uranium Mines Ltd.	609.8	205.2	U
	Hobbs, L.G.	220.8	1.6	U
Murchison	Comet Quartz	336.0	283.0	Quartz
Ryerson	Graphite Corp. of Canada	1 338.0	1 299.5	Graphite
	Ryerson Graphite	1 113.0	1 044.8	Graphite
Snowdon	Sulpetro Minerals Ltd.	11 320.3	10 600.2	Zn
Total		63 437.5	49 553.2	

There are other interesting zinc occurrences in the district's marble belts; the occurrences are typically hosted by dolomite or siliceous dolomite. Carter (1984) and Malczak et al. (1985) provided descriptions of many zinc occurrences. The possible association of zinc with shallow to intertidal facies of carbonate deposition makes the map "Lithofacies, stromatolite localities, metallic mineral occurrences, and geochemical anomalies associated with carbonate metasediments of the Burleigh Falls–Bancroft–Madoc area, Southern Ontario" by Bartlett and DeKemp (1987), a possibly useful tool for zinc exploration.

The newly published Mineral Deposits Circular (MDC 28) by Grant et al. (1989) contains information on the geochemistry of marble in the district. Data in Grant et al. (1989) were previously released in open file reports (Papertzian and Kingston 1982a, 1982b; Grant and Kingston 1984). The 1700 multielement whole rock analyses of eastern Ontario marble which were used in these reports can be obtained on floppy disk from the Resident Geologist. These reports and data may be useful in a zinc exploration program.

INDUSTRIAL MINERALS

Paper makers across North America are adopting the alkaline process which allows the use of calcium carbonate as a paper filler, causing increased demand for this material. Exploration in the district for white, high-purity calcitic marble is recommended, and Grant et al. (1989) is a useful reference for this exploration.

Fluorite is a strategic mineral which could be produced in Ontario. The Madoc area in the Southeastern District is known to have substantial fluorite occurrences, and consequently exploration is recommended. Thompson and Williams (1989) contains useful information for fluorite exploration.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

G. Di Prisco, Precambrian Geology Section, mapped the Elzevir–Madoc area, which adjoins recently published mapping by Wolff (1982a) to the east, and Bright (1986) to the south. H. Meyn, the Southern Region's specialist, performed detailed mapping around mineral occurrences in the Queensborough area in support of this project. Results of Di Prisco's work were displayed as Open File Map 128 (Di Prisco 1989) at the Ontario Mines and Minerals Symposium in Toronto.

M. Easton, Precambrian Geology Section, carried out a geological mapping program in Madoc Township focussing on the alteration of the rocks surrounding the Deloro felsic intrusion. Di Prisco, Meyn and Easton jointly led a field trip for OGS and Regional staff, during which they convincingly demonstrated that many rocks which were previously mapped as "felsite" are actually silicified sedimentary and volcanic rocks.

G. McFall, Engineering and Terrain Geology Section, continued to investigate neotectonic features in Prince Edward County. Publications relating to southeastern Ontario, released in 1989, are listed in Table 18.6.

REFERENCES

Bartlett, J.R. and DeKemp, E.A. 1987. Lithofacies, stromatolite localities, metallic mineral occurrences, and geochemical anomalies associated with carbonate metasediments of the Burleigh Falls–Bancroft–Madoc area, Southern Ontario; Ontario Geological Survey, Preliminary Map P.3079, scale 1:126 720.

Bright, E.G. 1986. Geology of the Mellon Lake area; Ontario Geological Survey, Open File Report 5598, 197p.

Caley, W.F., Didyk, S.H. and Kingston, P.W. 1989. Reduction of slag-lime in secondary steelmaking ladles; a presentation given at the Unified International Technical Conference on Refractories, First Biennial Worldwide Conference on Refractories, held in Anaheim, California on November 1-4, 1989, hosted by the American Ceramic Society, Incorporated.

Carter, T.R. 1984. Metallogeny of the Grenville Province, NTS 31/SW, southeastern Ontario; Ontario Geological Survey, Open File Report 5515, 422p.

Dickson, T.B. and Trinder, I.D. 1989. Report on the 1989 phase 1 exploration program fluorite-barite properties Madoc and Huntingdon townships, Ontario NTS 31 C/5, C/6, C/11, C/12, prepared for Harrington Sound Resources Incorporated by Derry, Michener, Booth and Wahl; Ministry of Northern Development and Mines, Assessment File 2.12688.

Di Prisco, G. 1989. Geology of the Elzevir area; Ontario Geological Survey, Open File Map 128.

Envoy, R.W., Weber, M.D., Dickson, T.B. and Trinder, I.D. 1989. Report on the 1989 phase 1 geological exploration program Bancroft area graphite properties Herschel and Lyndoch townships, Ontario NTS 31 E/1 and 31F/4, prepared for Harrington Sound Resources Incorporated by Derry, Michener, Booth and Wahl; Ministry of Northern Development and Mines, Assessment File 2.12748.

Grant, W.T. and Kingston, P.W. 1984. Geology and geochemistry of Grenville marble in southeastern Ontario; Ontario Geological Survey, Open File Report 5509, 297p.

Grant, W.T., Papertzian, V.C. and Kingston, P.W. 1989. Geochemistry of Grenville marble in southeastern Ontario; Ontario Geological Survey, Mineral Deposits Circular 28, 266p.

Kingston, P.W., MacKinnon, A. and Caley, W.F. 1989. New industrial mineral opportunities in eastern Ontario; paper presented at the 91st Annual General Meeting of the Canadian Institute of Mining and Metallurgy, April 30 to May 4, 1989, at Quebec City.

Kingston, P.W., van Haaften, S., Williams, D.A., Wolf, R.R., MacKinnon, A., Black, S.J., LeBaron, P., Caley, W.F., Gorrell, G.A., Grant, W.T., Meyn, H.D., Thompson, L.G.D. and Papertzian, V.C. 1989. Southeastern Resident Geologist's District – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, 391p.

Malczak, J., Carter, T.R. and Springer, J.S. 1985. Base metal, molybdenum, and precious metal deposits of the Madoc–Sharbot Lake area, southeastern Ontario; Ontario Geological Survey, Open File Report 5548, 394p.

Northern Miner Press Limited. 1989. Canadian Mines Handbook 1989–90; Northern Miner Press Limited, Toronto.

Papertzian V.C. and Kingston, P.W. 1982a. Chemistry of Grenville carbonate rocks, NTS 31D, 31E, Southern Ontario; Ontario Geological Survey, Open File Report 5378 (first part), 81p.

——1982b. Appendix to chemistry of Grenville carbonate rocks, Southern Ontario; Ontario Geological Survey, Open File Report 5378 (part two), 33p.

Storey, C.C. and Vos, M.A. 1981. Industrial minerals of the Pembroke–Renfrew area, part 2; Ontario Geological Survey, Mineral Deposits Circular 22, 214p.

TABLE 18.6. MINES AND MINERALS DIVISION, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, AND GEOLOGICAL SURVEY OF CANADA PUBLICATIONS RELATING TO SOUTHEASTERN DISTRICT RELEASED IN 1989.

PUBL NUMBER	CITATION
**** PUBLICATION TYPE: MAP**	
MAP 1957b	Haliburton–Bancroft Area, compiled by D.F. Hewitt and J. Satterly 1957, scale 1:126,720. This OGS map was reprinted in 1989, in two colours only.
MAP 2515	Lavant Area, Lanark and Frontenac Counties. Geology by Liba Pauk, scale 1:31,680. Precambrian Geology Series. OGS Map.
OFM 128	Geology of the Elzevir Area, by G. DiPrisco, scale 1:20000. This OGS Open File Map is available for viewing only, at the Resident Geologist's office in Tweed, and at the OGS Library.
P 3125	Quaternary Geology of the Golden Lake Area, Renfrew County (31 f/11). Geology by P.J. Barnett and Brent Ainsworth, 1978, 1980, and 1985. Scale 1:50000. OGS map.
**** PUBLICATION TYPE: PAMPHLET**	
	'89 Directory, Ontario Building Stone Producers, by the staff of the Mineral Development and Lands Branch.
	Index to Geological Data Inventory Folios, Southern Region. This index, published by OGS, is current to May 1989.
	Industrial Minerals in Ontario, compiled by the staff of Mineral Development Section, 16 p.
	Ontario Mining Today, by Ministry of Northern Development and Mines.
	Ontario's Mineral Wealth, jointly produced by Eneregy, Mines and Resources Canada, and the Ministry of Northern Development and Mines.
	Rocks and Minerals Information 1989, 35p. Compiled by the Geoscience Information Office, Ontario Geological Survey.
**** PUBLICATION TYPE: REPORT**	
	1988 DIRECTORY OF MINERAL EXPLORATION COMPANIES IN ONTARIO, prepared by Mineral Development and Lands Branch, 150p.
	1988 Ontario Mineral SCORE (Screen Co-ordinated Resource Evaluation), by staff of the Information and Statistics Section of Mineral Development and Lands Branch.
	Limestone Industries of Ontario, by Derry Michener Booth and Wahl, and staff of the Engineering and Terrain Geology Section, Ontario Geological Survey, published by the Ministry of Natural Resources, Land Mangement Branch, in three volumes.
	Rehabilitation of Pits and Quarries for Forest Production, by T.W. Hilditch, G.A. Sinclair, and C.P. Hughes, Ministry of Natural Resources, Land Management Branch, 28p.
	THE EXPLORE REPORT for Mineral Exploration and Development Performed in Ontario in 1987, prepared by Mineral Development and Lands Branch. Text, Charts, Graphs, 50p.
IMBP 11	Inorganic Chemicals: Prospects for Ontario's Industrial Minerals, by Law, Sigurdson & Associates and SRI International, 93p. Prepared for the Mineral Development and Lands Branch.
MDC 28	Geochemistry of Grenville Marble in Southeastern Ontario, by W.T. Grant, V.C. Papertzian and P.W. Kingston, 266p. OGS Mineral Deposits Circular.
MP 77	Index to Published Reports and Maps, 1987 Supplement, prepared by the Geosience Data Centre, Ontario Geological Survey, 85p.
MP 142	Report of Activities 1988, Resident Geologists, edited by K.G. Fenwick, P.E. Giblin, and A.E. Pitts, 391p. OGS Miscellaneous Paper.
MP 146	Summary of Field Work and Other Activities 1989, 275p. OGS Miscellaneous Paper.
MRC 12	Copper, Nickel, Lead and Zinc Deposits in Ontario, edited by Roman Shklanka, Ontario Department of Mines, 1969, 394p. Reprinted in 1989. OGS Mineral Resources Circular.
OFR 5706	Building Stone Potential in Eastern Ontario, by P.S. LeBaron, C.P. Verschuren, V.C. Papertzian, and P.W. Kingston, 539p., 75 figures, 9 tables, 252 photos, and 5 appendices. OGS Open File Report.
OFR 5711	Vermiculite in the Stanleyville Area, Lanark County, Eastern Ontario, by A. McKinnon, P.W. Kingston, and J.S. Springer, 87p., 13 figures, 12 tables, 3 photos, 3 appendices, and 1 map in back pocket. OGS Open File Report.
OFR 5714	Talc in Southeastern Ontario, by P.S. LeBaron and Steven van Haaften, 240 p. OGS Open File Report.
RPT 253	Geology of the Lavant Area, Lanark and Frontenac Counties, by Liba Pauk, 61 p. Accompanied by Map 2515, scale 1:31680. OGS Report.
RPT 262	Quaternary Geology of the Bancroft Area, Southern Ontario, by P.J. Barnett, 93 p. Accompanied by Map 2500, scale 1:50000. OGS Map.

Thompson, L.G.D. and Williams, D.A. 1989. Exploration targets in the Madoc fluorite area, Southern Ontario; *in* Summary of Field Work and Other Activites 1989, Ontario Geological Survey, Miscellaneous Paper 146, p.180-185.

Wolff, J.M. 1982. Geology of the Long Lake area, Lennox and Addington and Frontenac counties; Ontario Geological Survey, Report 216, 76p.

——1982a. Geology of the Kaladar area, Lennox and Addington County; Ontario Geological Survey, Report 215, 94p.

19. Southwestern Resident Geologist's District—1989

B.H. Feenstra

Resident Geologist, Southwestern Resident Geologist's Office, Southern Ontario Region.

INTRODUCTION

The industrial mineral resources of the Southwestern Resident Geologist's District provide the bulk of Ontario's nonmetallic mineral and structural material wealth; namely, all of the province's gypsum and salt production, nearly all of the clay and shale production, and most of the crushed stone, sand and gravel, calcined lime, cement and building stone from "limestone" production.

The development of the No. 3 Gypsum Mine by Domtar Incorporated at Caledonia currently represents the largest industrial mineral development project in the Southwestern District. Mineral exploration in the district is primarily for oil and gas and construction aggregate resources on private land.

MINING ACTIVITIES

The locations of all operating underground mines and selected operating quarries in the Southwestern Resident Geologist's District are shown in Figure 19.1.

SALT

Rock salt is extracted from the Salina Formation by underground mining methods at Goderich and Windsor. At the Goderich Mine, Domtar Incorporated (Chemicals Group-Sifto Salt Division) uses a modified room-and-pillar design in the 23 m thick A-2 Unit bed at a depth of 537 m. In September, Domtar Incorporated sold the Sifto Salt Division works at Goderich to Carey Salt Holdings of Kansas.

At the Ojibway Mine in Windsor, The Canadian Salt Company Limited employs a conventional room-and-pillar method in the 7.5 m thick Middle F Unit bed at a depth of 297 m.

Rock salt is primarily used in de-icing (80 to 85%), in the manufacture of chloralkalis (12 to 20%), and in minor miscellaneous markets.

GYPSUM

Gypsum is extracted from the Salina Formation by underground room-and-pillar methods at Caledonia, Hagersville and Drumbo. Gypsum production is used chiefly for the manufacture of wallboard.

Domtar Incorporated (Construction Materials Group-Gypsum Division) mines a 2.5 m thick gypsum bed at a depth of 25 m at the No. 2 Mine at Caledonia. Eastward, the No. 3 Mine is currently under development and may start producing in 1990 or 1991. The mining operation utilizes new, safer continuous miner technology, eliminating the need for drilling and blasting. Mining reserves are estimated to be in excess of 75 years.

North of Hagersville, the Canadian Gypsum Company mines an approximately 1 m thick gypsum bed at a depth of 30 m. Near Drumbo, Westroc Industries Limited mines a 1.7 m thick gypsum bed at a much greater depth of 116 m.

BUILDING STONE

Adair Marble Quarries Division of Arriscraft Corporation quarries 10 t dimension stone blocks from blue-grey-mottled, thick-bedded Amabel Formation dolostone near Hope Bay, in the Bruce Peninsula. In 1989, the company also quarried a "sepia stone" from buff-coloured Amabel beds and continued to experiment with an Italian-made wire saw.

Owen Sound Ledgerock Limited quarries thin- to medium-bedded Eramosa dolostone at operations near Owen Sound and Wiarton for the production of flagstone, drywall stone, patio stone, hearths, mantels, sills and marble. The demand for Eramosa marble products is strong. During 1989, the company installed a track-mounted electric saw for recovery of quarry blocks at the Wiarton Quarry, and also installed stone dressing equipment at the Owen Sound plant, including a programmable electronic router.

RESIDENT GEOLOGIST'S ACTIVITIES

The office is located in the main provincial government building at 659 Exeter Road (Highway 135), London. The office maintains a publicly accessible geoscience and mineral resource information library, and is responsible for selling reports and maps published by the Mines and Minerals Division, prospector's licences and claim tags; staking and working claim forms are also available.

The Resident Geologist responded to inquiries from the public regarding mineral potential (shale, salt, aggregate resources), geological information for land use planning (highways, power lines, landfills) and general information on mining.

The Resident Geologist visited all 1989 field projects conducted by the Ontario Geological Survey in the Southwestern Resident Geologist's District; co-operated with the Ontario Geological Survey in drilling projects in shale resources, buried sand and gravel resources, and sediments in the buried St. Davids gorge; and supported a Section 38 gypsum project by S.J. Haynes at Brock University.

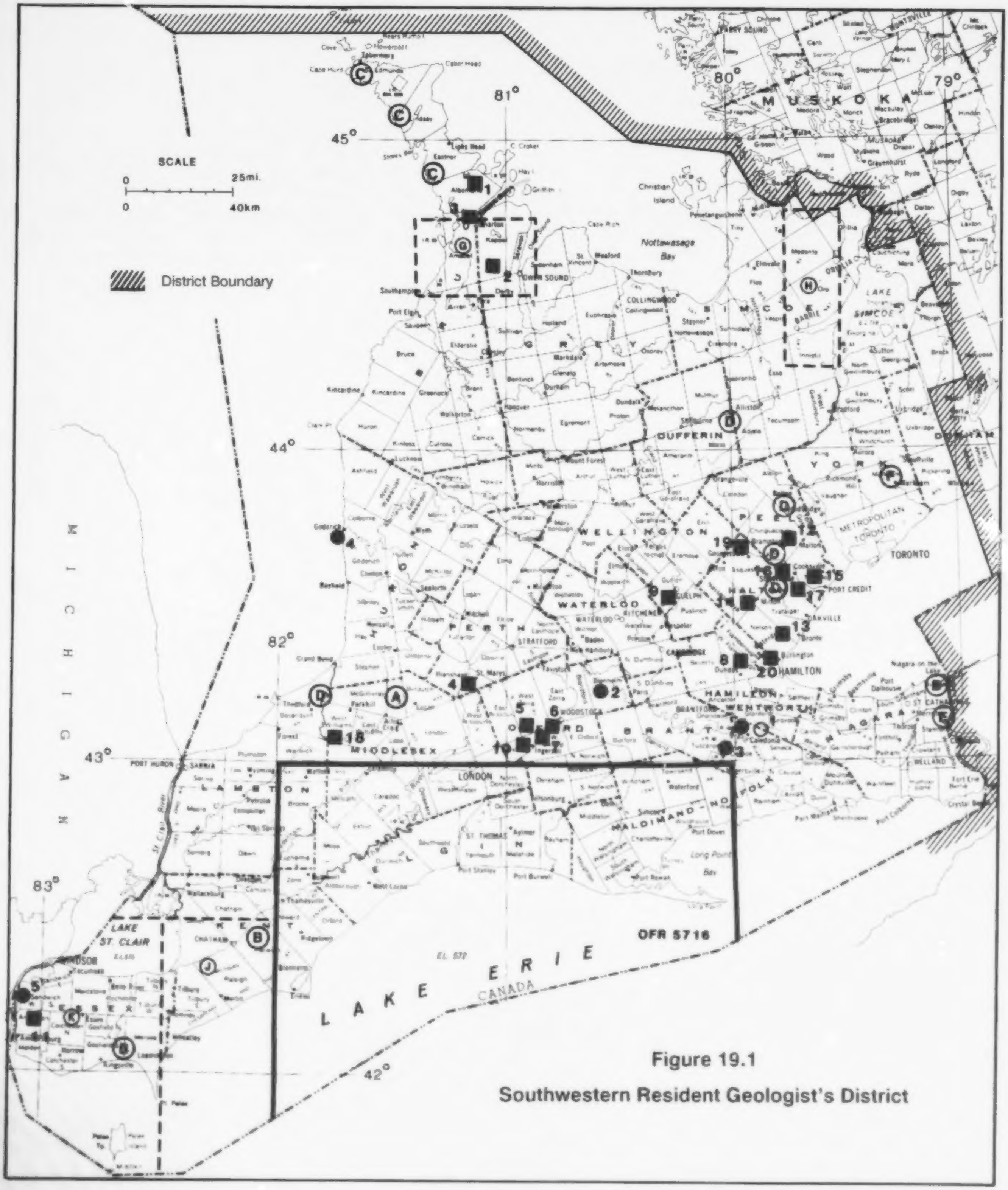

SCALE
0 25mi.
0 40km
District Boundary
81°
80°
79°
45°
44°
43°
42°
82°
83°
MUSKOKA
SIMCOE
GREY
DUFFERIN
YORK
PEEL
WELLINGTON
WATERLOO
HALTON
PERTH
OXFORD
BRANT
MIDDLESEX
LAMBTON
HAMILTON-WENTWORTH
NIAGARA
HALDIMAND-NORFOLK
ELGIN
KENT
ESSEX
DURHAM
METROPOLITAN TORONTO
TORONTO
OWEN SOUND
COLLINGWOOD
BARRIE
ORILLIA
GUELPH
KITCHENER
STRATFORD
WOODSTOCK
LONDON
HAMILTON
BRANTFORD
PORT CREDIT
OAKVILLE
PORT HURON
SARNIA
CHATHAM
WINDSOR
ST. THOMAS
ST. CATHARINES
WELLAND
Nottawasaga Bay
Christian Island
Lake Simcoe
LAKE ST. CLAIR
St. Clair River
Long Point Bay
LAKE ERIE
CANADA
MICHIGAN
OFR 5716
A
B
C
D
E
F
G
H
J
K
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Figure 19.1

Southwestern Resident Geologist's District

EXPLANATION

○ Location of Ontario Geological Survey Field Projects, 1989
  - A. Buried Sand and Gravel Aggregate Resources, McGillivray Township
  - B. Buried Sand and Gravel Aggregate Resources Drilling Program, Leamington and Pinehurst
  - C. Paleozoic Stratigraphy Drilling Program, Bruce Peninsula
  - D. Brick Shale Resources Drilling Program, Niagara River - Shelburne Area and Thedford
  - E. Quaternary Stratigraphy Drill Hole, St. Davids Buried Gorge at Niagara Falls
  - F. Overburden Sounding Research, Markham Township

⬚
  - G. Paleozoic Geology, Bruce Peninsula
  - H. Quaternary Geology, Barrie-Elmvale Area
  - J. Quaternary Geology, Chatham-Wheatley Area
  - K. Quaternary Geology, Essex County

▭ Maps/Reports Issued by Ontario Geological Survey, 1989

● Producing Mines, 1989

Gypsum
  1. Caledonia No. 2 - Domtar Inc.
  2. Drumbo - Westroc Industries Limited
  3. Hagersville - Canadian Gypsum Company

Salt
  4. Goderich - Domtar Inc.
  5. Ojibway - The Canadian Salt Company Limited

○ Mines Under Development, 1989

Gypsum
  1. Caledonia No. 3 - Domtar Inc.

■ Selected Producing Quarries, 1989

Limestone (L) / Dolostone (D)

Building Stone
  1. Adair No. 1 (D) - Adair Marble Quarries Division Arriscraft Corporation
  2. Owen Sound (D) - Owen Sound Ledgerock Limited
  3. Wiarton (D) - Owen Sound Ledgerock Limited

Cement
  4. St. Marys (L) - St. Marys Cement Company
  5. Woodstock (L) - Lafarge Corporation

Lime
  6. Beachville E. (L) - BeachviLime Ltd. (Dofasco)
  7. Beachville W. (L) - BeachviLime Ltd. (Dofasco)
  8. Dundas (D) - Steetley Lime and Aggregates
  9. Guelph (D) - Guelph Dolime Limited (BeachviLime Ltd.)
  10. Ingersoll (L) - Stelco Inc.
  11. McGregor (L) - General Chemical of Canada Ltd.

Shale

Brick
  12. Brampton - Brampton Brick Limited
  13. Burlington (Tansley) - Canada Brick Limited
  14. Milton - Canada Brick Limited
  15. Mississauga (Cooksville) - Canada Brick Limited
  16. Mississauga (Streetsville C.) - Canada Brick Limited
  17. Mississauga (Streetsville S.) - Canada Brick Limited

Brick and Drain Tile
  18. Arkona - Martin Clay Products
  19. Georgetown - Amos C. Martin Limited

Brick, Filter Tile, Flower Pots, Flue Liner and Sewer Pipe
  20. Burlington (Waterdown) - National Sewer Pipe Limited

K. Kennes (Experience '89 summer assistant) compiled information on operating and abandoned gypsum mine works for land use planning purposes by the town of Haldimand.

ONTARIO GEOLOGICAL SURVEY ACTIVITIES

The location of project areas in the Southwestern Resident Geologist's District, for which the Ontario Geological Survey published maps and reports during 1989, are outlined in Figure 19.1; the published maps and reports are listed in the section entitled Selected Publications Received.

The locations of 1989 field investigations by the Ontario Geological Survey in the Southwestern Resident Geologist's District are also shown in Figure 19.1. The following is a brief listing of these projects:

1. buried aggregate resources assessment: McGillivray Township
2. drilling - buried aggregate resources: Leamington and Pinehurst
3. drilling - Paleozoic stratigraphy: Bruce Peninsula
4. drilling - shale resources: Niagara River–Shelburne area and Thedford
5. overburden sounding research: Markham Township
6. Paleozoic geology: Bruce Peninsula
7. Quaternary geology: Barrie–Elmvale area
8. Quaternary geology: Chatham–Wheatley area
9. Quaternary geology: Essex County
10. sonic drill hole OGS-89-13: St. Davids buried gorge sediments, Niagara Falls

RESEARCH BY OTHER AGENCIES

ONTARIO GEOSCIENCE RESEARCH GRANT PROGRAM

The following academic studies pertaining to Southwestern Ontario received Ontario Geoscience Research Grants for the period 1989–1990:

1. M. Coniglio, Department of Earth Sciences, University of Waterloo, received Grant 351 for the study "Stratigraphy and sedimentology of the Upper Ordovician Georgian Bay Formation".
2. M. Coniglio, Department of Earth Sciences, University of Waterloo, received Grant 353 for the study "Diagenetic history of dolomitized Ordovician and Devonian oil and gas reservoirs".
3. H.C. Halls, Department of Geology, Erindale College, University of Toronto, received Grant 363 for the study "Seismotectonics of the western Lake Ontario region".
4. S.J. Haynes, Department of Geological Sciences, Brock University, received Grant 319 for the study "Gypsum deposits of southern Ontario".
5. F.J. Longstaffe, Department of Geology, University of Western Ontario, received Grant 357 for the study "Mineralogical and isotopic investigations of clastic diagenesis in Cambro-Ordovician strata of southwestern Ontario: implications for paleofluid flow and porewater evolution".
6. M.J. Risk, Department of Geology, McMaster University, received Grant 340 for the study "Facies and paleoecology of the Devonian Dundee Formation".
7. D.L. Smith, Department of Geological Sciences, Queen's University, received Grant 372 for the study "The Salina Group: relation to Guelph reef reservoir location and quality and the availability of industrial minerals, southwestern Ontario".

SELECTED PUBLICATIONS RECEIVED

The following maps and reports pertaining to the Southwestern Resident Geologist's District were published during 1989 by the Ontario Geological Survey and by the Ontario Ministry of Natural Resources.

Carter, T.R. 1989. Oil and gas exploration, drilling and production summary, 1986; Ontario Ministry of Natural Resources, Oil and Gas Paper 9, 132p.

Carter, T.R. and Trevail, R.A. 1989. Oil and gas exploration, drilling and production summary, 1985; Ontario Ministry of Natural Resources, Oil and Gas Paper 8, 212p.

Derry Michener Booth and Wahl and Ontario Geological Survey 1989a. Limestone industries of Ontario, Volume I - Geology, properties and economics; Ontario Ministry of Natural Resources, Land Management Branch, 158p.

——1989b. Limestone industries of Ontario, Volume III - Limestone industries and resources of central and southwestern Ontario; Ontario Ministry of Natural Resources, Land Management Branch, 175p.

Johnson, M.D., Telford, P.G., Macauley, G. and Barker, J.F. 1989. Stratigraphy and oil shale resource potential of the Middle Devonian Marcellus Formation, southwestern Ontario; Ontario Geological Survey, Open File Report 5716, 149p.

20. Petroleum Resources Section, Ministry of Natural Resources—1989

T.R. Carter

Senior Petroleum Geologist, Petroleum Resources Section, Ministry of Natural Resources.

INTRODUCTION

There was a major reduction in the exploration for, and the development of, oil and natural gas reservoirs in southwestern Ontario in 1989. A total of 105 drilling permits had been issued by December 4, 1989, compared to 213 for all of 1988. The slowdown can be attributed mainly to the termination of Canadian Exploration and Development Incentive Program (CEDIP)—a federally-funded drilling incentives program—and temporary cash-flow problems experienced by some Ontario-based companies.

Once again, the exploration and development of Ordovician reservoirs was the highlight of drilling activity in Ontario. Drilling of Ordovician targets was reported to be complete at 13 exploratory wells and 12 development wells by November 15, resulting in 12 new oil producers. Activity levels were increasing at the time of writing, and activity is expected to increase substantially in 1990 as competition to find new Ordovician pools becomes more intense, and operators are forced to drill or face expiry of their oil and gas leases.

Projected annual oil production for 1990 is expected to establish a new record, due entirely to production from new Ordovician pools. This trend of increased production supports the conclusions of earlier studies which predicted considerable remaining potential reserves in the Ordovician and Cambrian strata in Ontario.

OIL AND GAS PRODUCTION

Oil production in Ontario in 1989, up to and including October 31, 1989, totalled 203355 m^3, compared to 157203 m^3 by the same time in 1988. The projected production to the end of the year is estimated to be approximately 245000 m^3, a new record for annual production in Ontario. This represents a tripling of annual production since 1983, and is due entirely to production from newly discovered Ordovician pools.

Essex and Kent counties produced the largest proportion of Ontario's oil in 1988. The Hillman and Dover 7-5-V E pools, in Essex County and Kent County, respectively, were the two largest producers. Both pools were discovered in 1983, with eight other Ordovician pools put on production since that time, most of them located in Romney Township of Kent County. The Hillman pool is now fully developed, with 11 wells in production in 1988. The Dover 7-5-V E pool has nine oil wells and four gas wells, with some potential for further development. Most of the other Ordovician pools are still under development.

Annual production of natural gas, up to and including the end of September 1989, totalled 358.8 million m^3. Approximately 75 percent of the gas was from wells in Lake Erie. Projected production to the end of the year is estimated at 480 million m^3, compared to total production of 503.4 million m^3 in 1988.

Prices received by Ontario producers for both gas and oil increased during the year. The posted price offered by Esso Resources Canada Limited for Mersea Township crude oil as of November 1, 1989, was $144.84 per m^3, up from a low of $107.24 on November 29, 1988. The weighted average price paid to Ontario producers of natural gas by Union Gas Limited in October 1989 was $114.52 per thousand m^3, compared to a low of $73.91 in October 1988.

EXPLORATION AND DEVELOPMENT ACTIVITY

As indicated above, there was a significant decrease in drilling activity in 1989. Projected figures indicate that a total of approximately 105 wells will have been drilled in Ontario by the end of the year, compared to 192 in 1988.

Drilling results had been reported for a total of 78 wells at the time of writing. These consisted of 28 exploratory wells, 24 development wells and 26 service wells. The exploratory drilling resulted in three wells completed as gas producers and two as oil producers (Figure 20.1, Table 20.1). The development drilling resulted in eight wells completed as gas producers and twelve as oil producers. The service wells consisted of eight stratigraphic tests, one solution mining well, four observation wells, three brine disposal wells, and ten natural gas storage wells. All of the wells completed in 1989 were drilled onshore; no wells were drilled in Lake Erie.

Drilling of Ordovician targets dominated exploration and development activity in 1989, with drilling completed at 13 exploratory and 12 development wells by November 15. The exploratory drilling resulted in two wells completed as oil producers (*see* Table 20.1), while the development drilling resulted in ten oil producers. The Ordovician reservoirs are typically contained in porous dolomitized limestone along faults within the Trenton and Black River groups. The reservoirs are confined laterally by nonporous limestone with shales of the overlying Blue Mountain or Collingwood Formation forming the cap rock. The reservoirs show strong linear

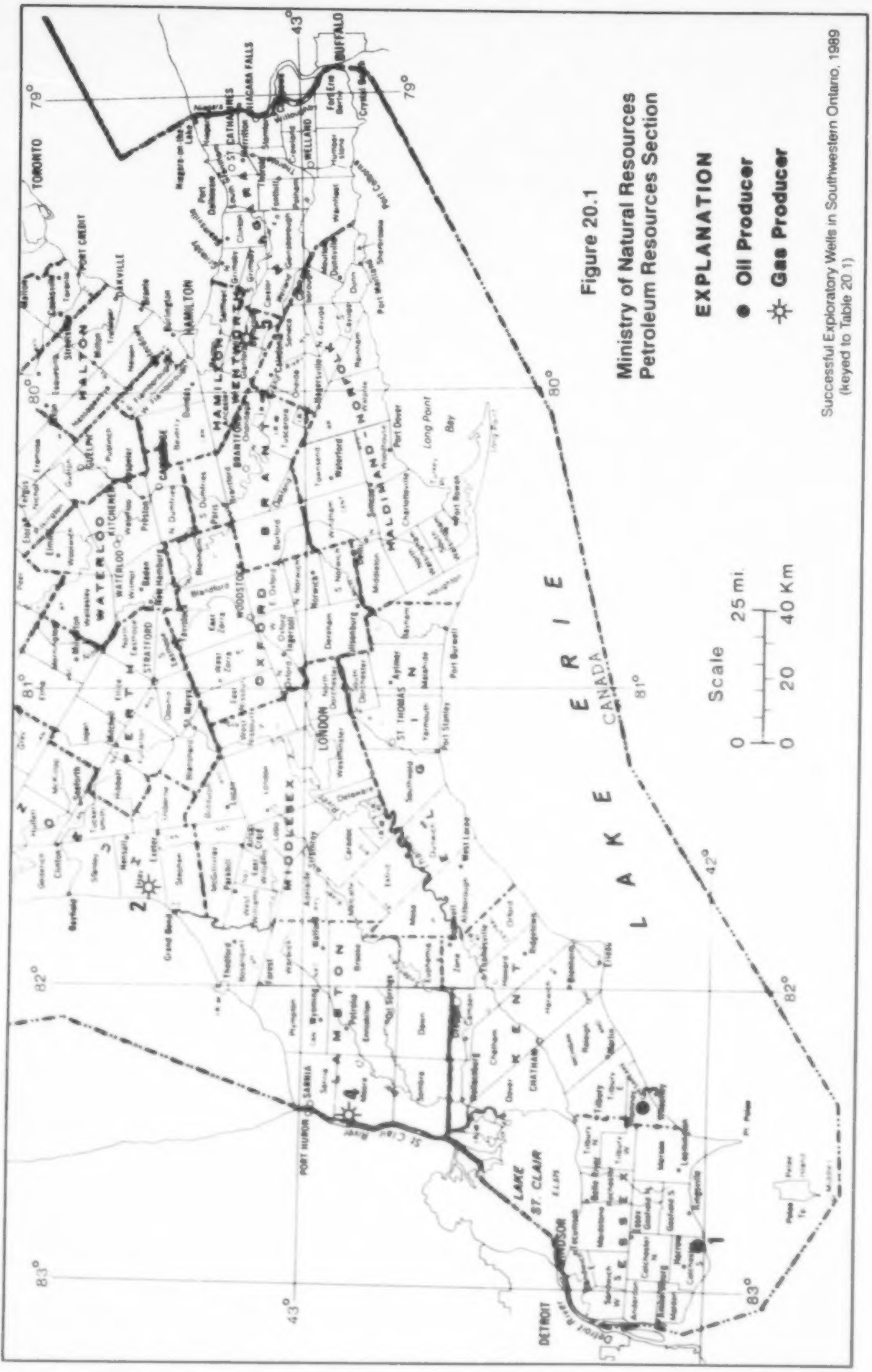

TORONTO
HAMILTON
BUFFALO
NIAGARA FALLS
ST. CATHARINES
WELLAND
KITCHENER
WATERLOO
STRATFORD
WOODSTOCK
BRANTFORD
LONDON
ST. THOMAS
SARNIA
PORT HURON
CHATHAM
WINDSOR
DETROIT
LAKE ST. CLAIR
LAKE ERIE
CANADA
HALTON
WATERLOO
PERTH
OXFORD
BRANT
HALDIMAND - NORFOLK
MIDDLESEX
LAMBTON
KENT
ESSEX
ELGIN
HURON
Long Point Bay
1
2
3
4
5
79°
80°
81°
82°
83°
42°
43°
Scale
0 20 25 mi.
0 20 40 Km
EXPLANATION
● Oil Producer
☼ Gas Producer

Figure 20.1

Ministry of Natural Resources
Petroleum Resources Section

Successful Exploratory Wells in Southwestern Ontario, 1989 (keyed to Table 20.1)

TABLE 20.1. SUCCESSFUL EXPLORATORY WELLS IN SOUTHWESTERN ONTARIO, 1989.

Map No.	Latitude Longitude	Well Name	Target	Metres Drilled	Class Status	Compl. Date
ESSEX COUNTY						
1	42°00′40″ 82°51′14″	PPC/Saskoil 1 Colchester South 42-Front	Ordovician	875.0	NPW OP	89.10.18
HURON COUNTY						
2	43°17′29″ 81°39′53″	Orford Res. et al. 3 Hay 5-12-XV	Salina-Guelph	599.5	NPW GP	89.01.20
KENT COUNTY						
3	42°08′41″ 82°24′19″	Senex Romney 7-17-III	Ordovician	861.5	NPW OP	89.04.04
LAMBTON COUNTY						
4	42°52′00″ 82°27′10″	Sungold Moore 4-50-Front	Salina-Guelph	810.0	NPW GP	89.06.20
WENTWORTH COUNTY						
5	43°08′35″ 79°49′25″	Laratta 1 Binbrook 2-7-Block 5-Front	Clinton-Cataract	123.7	NPW GP	89.06.09

trends, with strike directions varying from west to northwest.

Most of the new Ordovician pools discovered since 1983 are located in a small area in Essex County and southern Kent County. Another Ordovician pool was discovered in August of this year in St. Clair County, Michigan, on the west side of the St. Clair River opposite Lambton County. A well, targeted on Ordovician strata in Colchester South Township of Essex County, was reported to be a probable producer (*see* Figure 20.1). This greatly increases the area known to be productive for this type of pool. There has been a reported major increase in leasing of oil and gas rights by exploration companies on both sides of the international border in the vicinity of the Michigan discovery, and a 34.5 km speculative seismic survey has been shot by a seismic service company along the river in Ontario and offered for sale to interested clients.

Two Cambrian exploratory tests and one development well have been drilled to date in 1989. The exploratory wells were dry. The development well was successfully completed as a gas producer in an extension of the Blandford 3-7-VIII pool. Results of a 1988 Ordovician exploratory test were released in August of 1989. The well, known as Ram/BP 5 Raleigh 1-17-XIII, is reported to have been completed as a gas producer in Cambrian sandstones. Drill-stem tests indicate the well is capable of producing 26 500 m^3 of natural gas per day.

One Devonian development well has been recompleted as an oil producer after deepening to test its potential for use as a brine disposal well had disappointing results. One exploratory and four development wells have been drilled to test sandstones of the Clinton and Cataract groups, all of which have been completed as gas producers. Drilling of Guelph reef targets and dolomitized zones in the Salina A-1 and A-2 units consisted of twelve exploratory and four development wells. The exploratory drilling resulted in two gas producers; one in Moore Township, and the other in Hay Township. The development drilling resulted in three gas producers, all of which are in the Camden Gore 6-10-IX pool in dolomitized limestones of the Salina A-1 and A-2 units.

The federally-funded Canadian Exploration and Development Incentive Program (CEDIP) was terminated on April 27, 1989, subject to grandfathering rules for activities in progress or committed to under existing written agreements. The termination of the program is largely responsible for the decrease in exploration activity in Ontario since that time. Activity levels were beginning to increase again in December of 1989, and are expected to increase to normal levels in 1990.

STAFF ACTIVITIES

Geological program staff employed at the Petroleum Resources Section during the year consisted of T.R. Carter, Senior Petroleum Geologist; M. Narain, Aggregate Resources Geologist; M. Campbell, Petroleum Resources Laboratory Technician; D. Parker, Resource Geologist; and M. Bernardo, Clerk Typist. I. Hodder was employed during the summer as a laboratory assistant as part of the Experience '89 program. M. Narain was transferred to the Land Use Planning and Aggregates Section in the spring of 1989, and D. Parker resigned in order to take a position with Telesis Oil and Gas.

Engineering and administrative staff include P. Palonen, Mineral Resources Co-ordinator; R. Rybansky, Offshore Engineer; E. Habib, Onshore Engineer; J. Manocha, Brine Engineer; K. McLeod, Petroleum Engineering Technologist; C. Owen, Systems Analyst; F. McKeon, Data Processing Technician; I. Cameron, Draftsperson; S. Shanks, Program Secretary; B. Davidson, Clerk Typist; and G. Stephenson, Data Processing Technician. B. Davidson is now the Program Secretary for the Land Use Planning and Aggregates Section.

Petroleum Resources inspectors, responsible for enforcement of the Petroleum Resources Act and associated regulations, are located in the Simcoe and Chatham District offices. M. Hunter, Deputy Chief Inspector, L. Chambers, and B. Lewis are located in Simcoe. B. Sealey and R. Corea operate out of the Chatham office. K. McConnell and J. Chivers operate out of the Petroleum Resources Laboratory and are specifically responsible for brine disposal, solution mining and storage wells.

Geological staff continued their efforts to promote and encourage investment in Ontario's oil and gas industry by providing geological information, advice and interpretations. In addition to Ontario-based companies, numerous inquiries and/or office visits were made by industry representatives from Michigan and Calgary, with additional inquiries and visits from Oklahoma, Pennsylvania, Ohio, Colorado and Saskatchewan.

T.R. Carter presented a technical paper entitled "Recent exploration activity in Ontario" at the Ninth Annual Meeting of the Independent Oil and Gas Association of New York, which was held in Buffalo in November 1989. The paper focussed on current Ordovician exploration activity and on remaining potential in Ordovician and Cambrian strata in Ontario. T.R. Carter acted as co-chairman of the Technical Committee for the 28th Annual Meeting of the Ontario Petroleum Institute, which was held in London, Ontario, in October 1989. Carter will also be acting as the Field Trips and Core Workshop Chairperson for the Eastern Section Meeting of the American Association of Petroleum Geologists (AAPG), to be held in London, Ontario, in September 1990.

Oil and Gas Papers 7 and 8 were published by the Ontario Geological Survey in April 1989 (Trevail et al. 1989; Carter and Trevail 1989), and Oil and Gas Paper 9 was published in August (Carter 1989b). A manuscript entitled "Geology of selected oil and gas pools in the Silurian carbonates of southern Ontario" accompanied by 41 maps was released in January 1990 (Bailey Geological Services and Cochrane 1990). The annual paper for the American Association of Petroleum Geologists summarizing exploration and development activity in Ontario was published in November (Carter and Campbell 1989).

T.R. Carter continued work on a long-term project of subsurface mapping of Silurian carbonates in Lambton County. Work was also begun on a complementary project documenting the stratigraphic and geographic extent of dolomitization in the Salina A-1 and A-2 units in Lambton County. Work has also begun on interpretation of the extension of Grenville basement beneath southwestern Ontario, in conjunction with R.M. Easton of the Ontario Geological Survey. The preliminary results of the basement mapping project will be the subject of a core workshop presentation at the AAPG Eastern Section Meeting in London in 1990.

DRILL SAMPLE STORAGE

Routine collection, processing, and cataloguing of core and drill-cuttings samples from all wells permitted under the Petroleum Resources Act continued in 1989. Several important new additions to the drill core collection were made in 1989. These include the following: Ram/BP 5 Raleigh 1-17-III (Cambrian to Precambrian); Pembina Lake Erie 89-H-2 (Cabot Head Formation to Queenston Formation); Tec-Dow 14 Moore 4-22-XII (A-1 Carbonate Unit to Guelph Formation); and Tec-Kim-Col 54 Moore 8-17-V (A-2 Anhydrite Unit to Gasport Formation).

RECOMMENDATIONS FOR EXPLORATION

Ordovician oil reservoirs remain the most attractive targets for exploration in southwestern Ontario. These reservoirs occur in dolomitized limestones associated with vertical faults in the Trenton and Black River groups. Most recent exploration success has been confined to Dover and Romney townships in Kent County, and Mersea Township in Essex County, although in November, PPC/Saskoil 1 Colchester South 42-Front was reported to be a potential oil producer. If tests currently underway are successful, this well will significantly broaden the area in Essex County under active exploration. In addition, the recent successful completion of a well in St. Clair County, Michigan as an oil producer should result in an expansion of Ordovician exploration activity to Lambton County to the north. There has also been significant production of natural gas from these kinds of traps, from reservoirs in Kent and Lambton counties, and smaller reservoirs to the north in Bruce, Grey, and Wellington counties. The entire area between should be explored for natural gas reservoirs.

There continues to be a significant amount of exploration for Silurian reef reservoirs and for traps formed by dolomitized zones in the A-1 and A-2 Carbonate units of the Salina Group, principally in Lambton County. Reservoirs of this type can be very profitable due to the high prices received by Ontario producers of natural gas, proximity to pipelines, and the value of the depleted reservoirs for use as natural gas storage reservoirs.

There has been only a limited amount of recent exploration for oil and gas reservoirs in Cambrian strata in southwestern Ontario, despite the prediction of very large remaining potential reserves of both oil and gas (Carter 1989a). Hydrocarbons are contained within structural and/or stratigraphic traps in Cambrian sandstones and sandy dolostones. The structural traps are formed by tilted fault blocks similar to the faults and fault blocks associated with the Ordovician pools. The same exploration methods employed for Ordovician reservoirs should be applicable to these Cambrian structural traps, i.e., delineation of favourable areas by geological studies, followed by location of faults and selection of targets using seismic data.

RESEARCH BY OTHER AGENCIES

One BSc thesis was completed on a topic relevant to oil and gas exploration in southwestern Ontario in 1989 (Donaldson 1989). Work is also underway on several projects funded by the Ontario Geoscience Research Grant Program.

1. Karst episodes and permeability development, Silurian reef reservoirs, southwestern Ontario; D.L. Smith and S. Charbonneau, Queen's University, Kingston
2. The Salina Group: relation to Guelph reefs and the availability of industrial minerals, southwestern Ontario; D.L. Smith, Queen's University, Kingston
3. Diagenesis of Middle Ordovician carbonate reservoirs, southwestern Ontario; M. Coniglio and K. Middleton, University of Waterloo, Waterloo
4. Styles of reservoir development in Middle Devonian carbonates, southwestern Ontario; M. Coniglio and D. Hamilton, University of Waterloo, Waterloo
5. Sedimentology and correlation of the Upper Ordovician Georgian Bay Formation, Manitoulin Island and Bruce Peninsula; M. Coniglio and M.C. Byerly, University of Waterloo, Waterloo
6. Facies and paleoecology of the Devonian Dundee Formation, southwestern Ontario; M.J. Risk and M. Birchard, McMaster University, Hamilton
7. Mineralogical and isotopic investigations of clastic diagenesis in Cambro-Ordovician strata of southwestern Ontario: implications for paleofluid flow and porewater evolution; F.J. Longstaffe, M. Wadleigh, S.K. Frape, C. McKenna and R.H. McNutt, University of Western Ontario, London

REFERENCES

Bailey Geological Services and Cochrane, R.O. 1990. Geology of selected oil and gas pools in the Silurian carbonates of southern Ontario; Ontario Geological Survey, Open File Report 5722, 50p.

Carter, T.R. 1989a. Petroleum Resources Section, Ministry of Natural Resources – 1988; *in* Report of Activities 1988, Resident Geologists, Ontario Geological Survey, Miscellaneous Paper 142, p.385-391.

——1989b: Oil and gas exploration, drilling, and production summary, 1986; Ontario Ministry of Natural Resources, Oil and Gas Paper 9, 132p.

Carter, T.R. and Campbell, G.R. 1989. Oil and gas developments in eastern Canada in 1988; American Association of Petroleum Geologists Bulletin, v.73, no.10B, p.45-56.

Carter, T.R. and Trevail, R.A. 1989. Oil and gas exploration, drilling, and production summary, 1985; Ontario Ministry of Natural Resources, Oil and Gas Paper 8, 212p.

Donaldson, W.S. 1989. The depositional environment of the Queenston shale, southwestern Ontario; unpublished BSc thesis, University of Western Ontario, London, 106p.

Trevail, R.A., Pakvis, P.J. and Brown, S. 1989: Oil and gas exploration, drilling, and production summary, 1984; Ontario Ministry of Natural Resources, Oil and Gas Paper 7, 190p.